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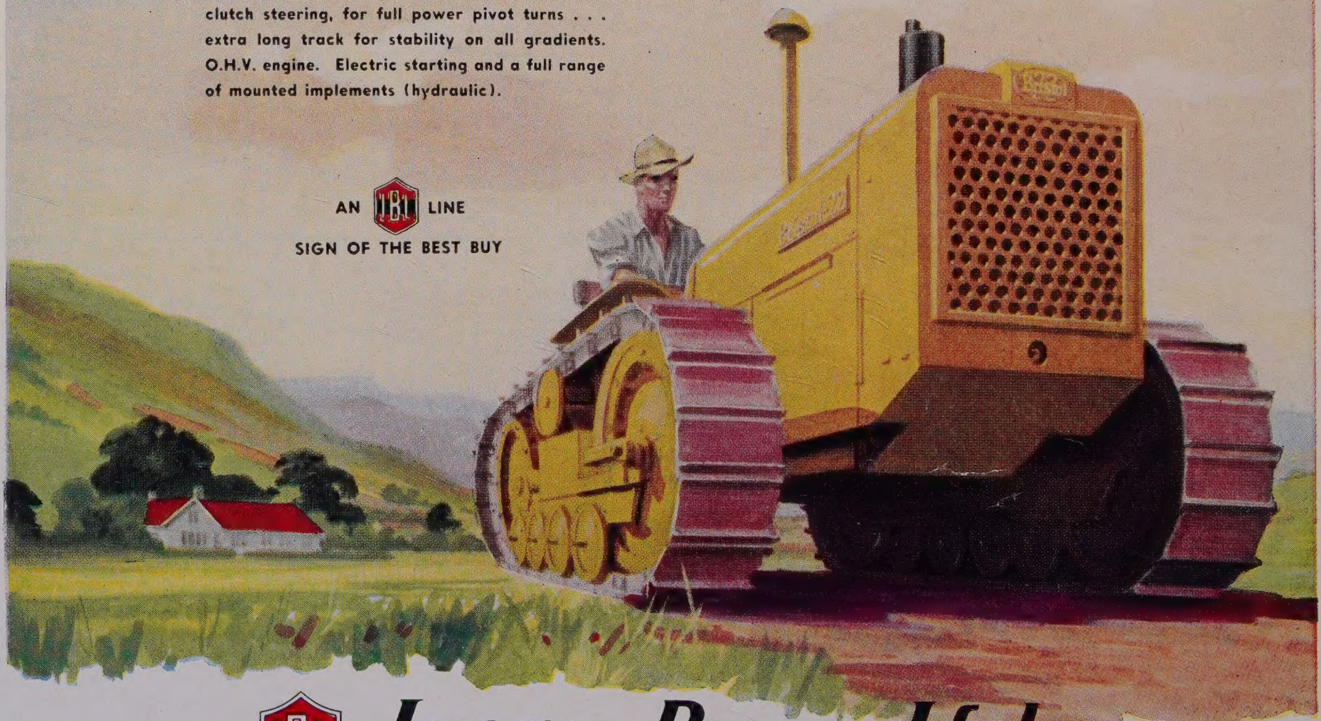

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NEW ZEALAND JOURNAL OF Agriculture

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This Month's Cover

Most of New Zealand's 14 million acres of native grassland is in the mountainous country of the South Island. This high country is used almost entirely for the grazing of Merinos and other fine-woolled sheep for the production of wool, and management of this land presents many problems. This month's cover, which was reproduced from a colour photograph by R. Kingsbury, shows disappearing tussock being replaced by moving screes of shingle on Mt. Possession run in the Ashburton Gorge area, Canterbury.

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REGISTERED AT THE G.P.O., WELLINGTON, AS A MAGAZINE.

RUAKURA FARMERS' CONFERENCE

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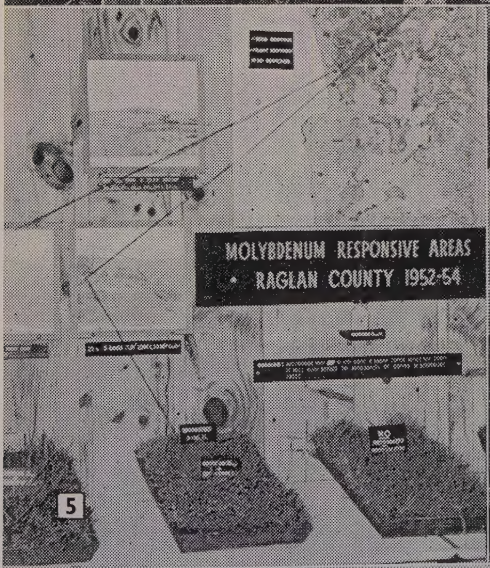
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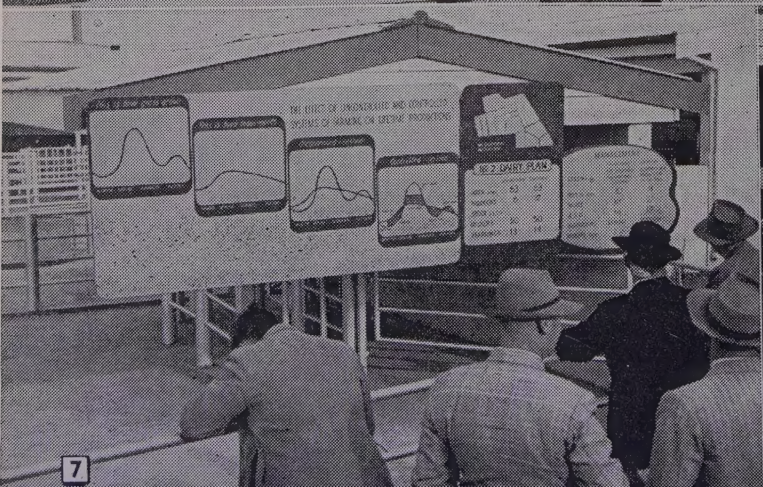
The field day at Ruakura Station. 1—Inspection of calves at No. 2 dairy reared under Dr. McMeekan's "foolproof" system. 2—Refreshments at a booth at the fertility centre. 3—Demonstration point at the 250lb. of meat per acre plus wool project. 4—Hogget rearing demonstration at the woolshed. 5 and 6—Rukuhia Soil Research Station displays. 7—Demonstration of advantages of controlled versus uncontrolled grazing of young dairy stock. 8—Causes and control of infertility in dairy cattle.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Farmers' Conference and Field Day at Ruakura

By G. J. NEALE, Editor, Department of Agriculture, Wellington

MASS extension work to farmers on animal husbandry and other aspects of the animal industry was carried out on a scale unprecedented in New Zealand when about 4000 people attended the field day at Ruakura Animal Research Station, Hamilton, last month during the 6th Ruakura Farmers' Conference Week.

THE conference week, first held in 1949 primarily to report to farmers on the progress of the animal research work of the Department of Agriculture and to attempt to alleviate the disorganisation of research work throughout the year by the increasing volume of sporadic visits of farmers and others to the Ruakura Station, has become increasingly popular each year. The basic form of the first conference—a conference day for sheep farmers, a field day for all farmers, a conference day for all farmers, and a conference day for dairy farmers—has been retained in subsequent conference weeks, and the inclusion in the panel of speakers of primary industry personalities other than research workers has been developed. This year, as in previous conferences, forums at night sessions which discussed themes of major industry importance drew large attendances and stimulated keen discussion.

Future of Such Meetings

In prefatory remarks to his paper to the conference on "Some Aspects of the Future of Agriculture in New Zealand" Mr. E. J. Fawcett, Director-General of Agriculture, referred to his visit to the field day at the Station during the previous year's conference, when he thought "we had reached the peak". "Today," he said, "the numbers on this Station surpassed all expectations. There was somewhat of a stampede here and at Whatawhata [the Hill Country Station, Raglan]. We are wondering what the future holds for this type of meeting."

In expressing his appreciation of the work put into the arranging of the conference by staff at Ruakura and Whatwhata, Mr. Fawcett said they regarded the days and nights spent preparing for it as part of their job, which was to carry out research work at the two Stations, work which was always considered of an essentially practical nature, to the benefit of the individual farmer and through him to the country as a whole.

"In 1939, when we established the Animal Research Station at Ruakura," Mr. Fawcett said, "our future appeared to depend essentially on the utilisation of pasture by stock. We pulled together the whole of the animal research staff of the Department and concentrated it at Wallaceville and Ruakura. As I have seen these Stations develop I can say the men and women on them have done a very good job. It appears obvious that farmers of the Waikato and surrounding districts will continue to show the interest in the work here that they have undoubtedly shown in the past few years and we must devise ways of handling increasing crowds. Obviously we cannot accommodate enough people in this hall [the staff centre at Ruakura]."

Mr. E. J. Fawcett, Director-General of Agriculture: So much of the work at Ruakura is of national importance.

Mr. Fawcett announced the approval by Cabinet two days before of the calling of tenders for the erection of the new laboratory building at Ruakura. The new block was essentially for the housing of the chemists at present in the unsuitable building at the old munitions site at Galloway. It was hoped that the present administrative buildings at Ruakura would eventually house the veterinary diagnostic centre for the south Auckland district.

"We are trying to cater for the needs of agriculture in this district and others far removed from here. So much of the work we are doing here is of national importance. It is important that the workers should have the best equipment that can be got for them, though it is not necessarily the best equipment or buildings with which the best work is done. I am proud to see how the staff themselves have gone about providing facilities for themselves," Mr. Fawcett concluded.

When the first Ruakura conferences were held there was no accommodation at the Station for public meetings and until the staff centre was built by the volunteer efforts of the staff public halls had to be used for all conference sessions. The seating accommodation of the staff centre (just under 300) was inadequate for this year's sessions for sheep farmers held at the centre, and the Hamilton theatre (accommodating 1000) used for some of the sessions was fairly filled. The rapidly increasing interest of sheep farmers in the Ruakura conference emphasised the growing contributions of the Station to sheep industry problems.

HEADING PHOTOGRAPH: One of the fleet of 12 buses that circuited Ruakura throughout the field day arrives at the woolshed.

RUAKURA FARMERS' CONFERENCE

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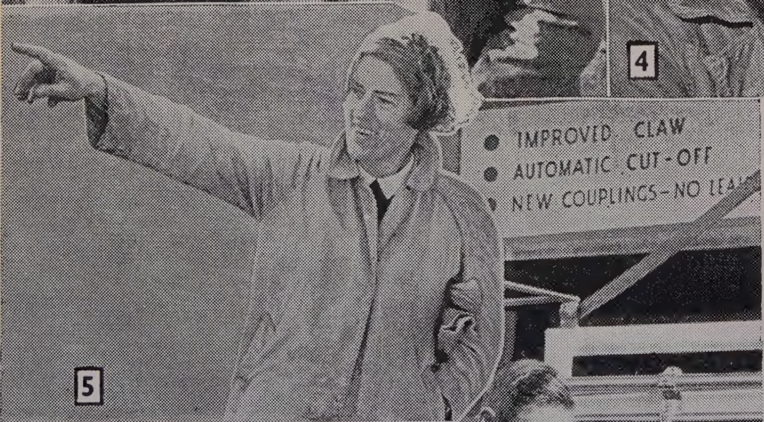

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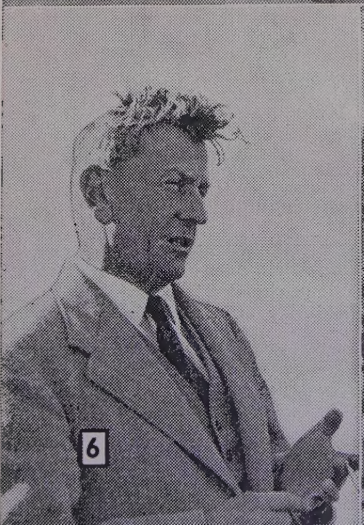

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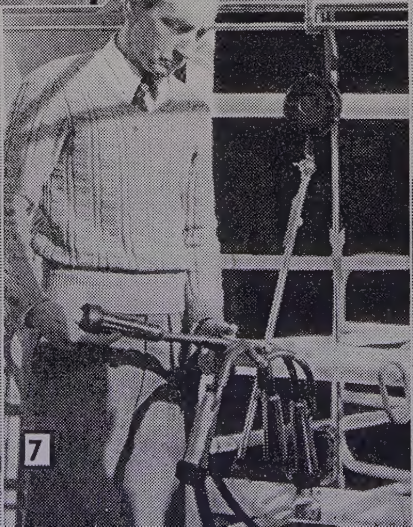

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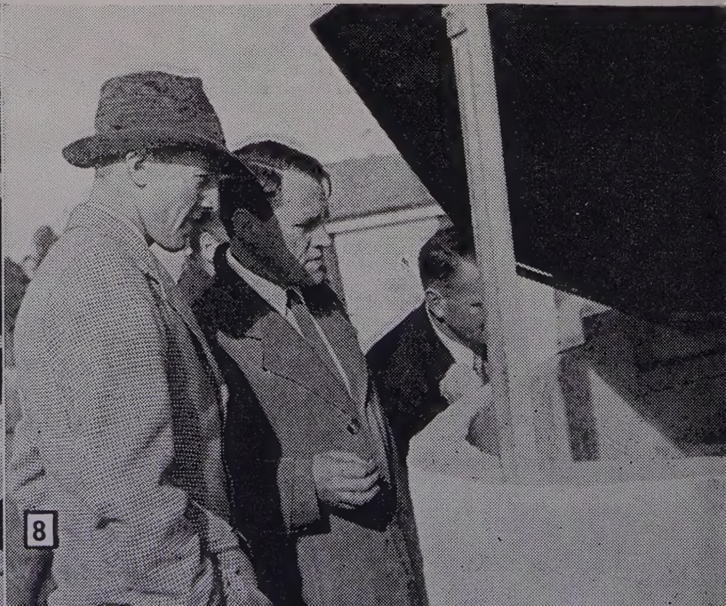

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Some personalities of the conference. 1—Dr. I. J. Cunningham, superintendent, Wallaceville Animal Research Station. 2—Dr. McMeekan, Mr. W. Sloane, British Phosphate Commission, and Mr. Fawcett. 3—Dr. W. M. Hamilton, Secretary, Department of Scientific and Industrial Research, and Mr. E. G. Griffiths, agricultural adviser to the United Kingdom High Commissioner. 4—S. A. Southcombe (right), superintendent of the Dairy Board's Artificial Breeding Centre, Newstead. 5—Miss D. E. Walker. 6—Dr. McMeekan. 7—D. S. M. Phillips. 8—D. M. Smith (centre).

Well-organised Field Day

Last year's field day appeared to be an unqualified success, when an attendance of 1300 was smoothly handled by a fleet of buses which circulated continuously round a fixed route on which there were stops to put down and pick up passengers who could spend as long as they liked at any of the 8 demonstration points. This technique of conducting a field day was one used at the Pennsylvania State College in the United States and which had impressed Dr. McMeekan when he attended the Sixth International Grassland Congress there. Before the adoption of this system at Ruakura neither staff nor visitors had been very satisfied with field days, as it seemed impossible to demonstrate the work of the Station effectively to groups of larger than 40 to 50 people.

This year, with an attendance of at least three times as many visitors as there were last year for the first trial of the system, there was again general satisfaction with the results, and there would certainly have been chaos without it. Throughout the day a fleet of 12 buses circulated continuously on a fixed route along which 10 demonstration points were arranged. A complication not foreseen by the organisers was the astonishing interest shown in the new Ruakura milking machine, which was displayed and demonstrated at the third stopping place on the route, No. 1 dairy. The crowd which swarmed here tended to delay the dispersal of visitors to subsequent demonstration points and while staff at centres early on the route had at times more visitors than they could effectively handle, others at later centres were comparatively neglected. Ultimately the huge crowd was sufficiently spread among all the projects to make effective demonstration possible and profitable to the visitors.

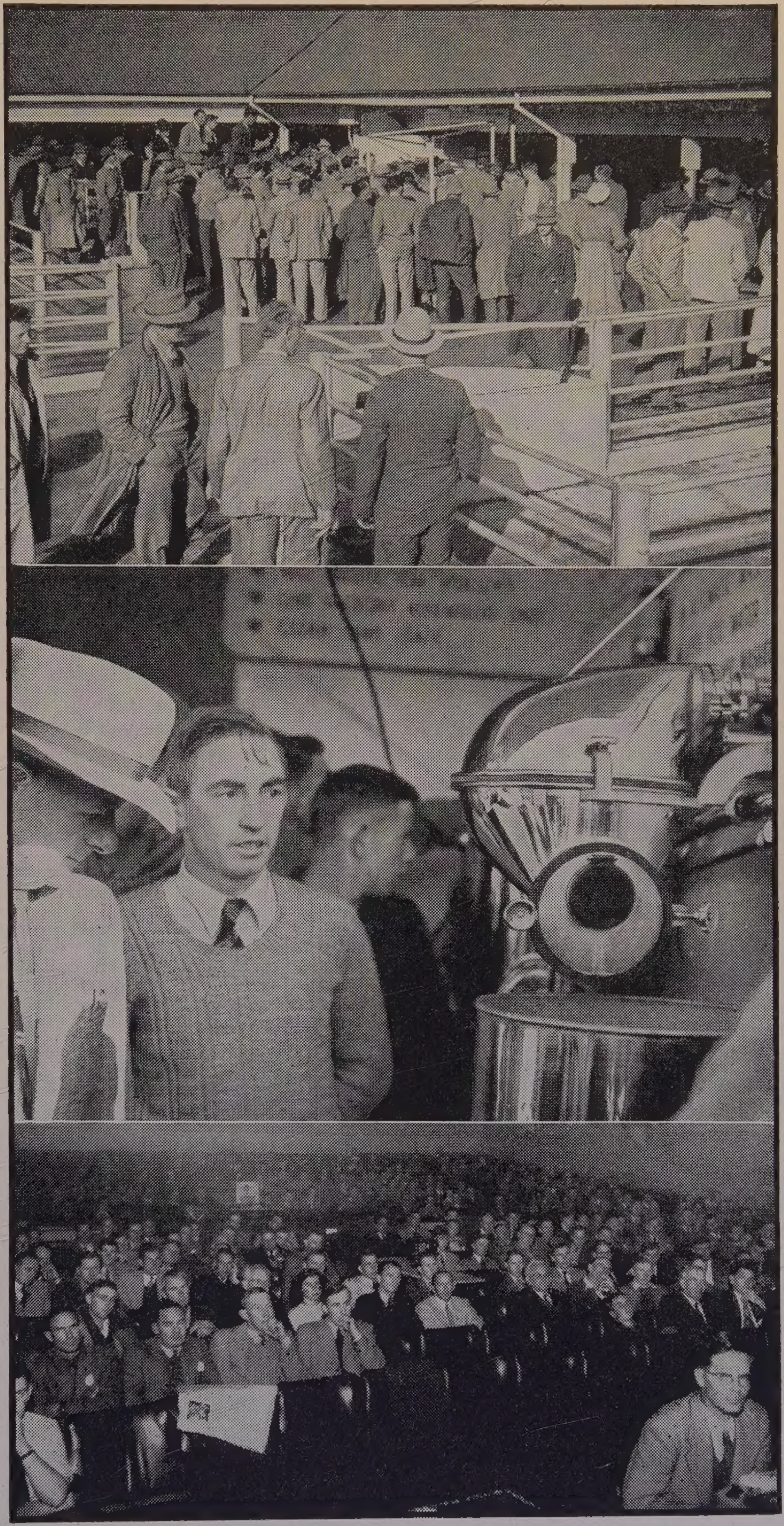
Papers and discussions at this year's Ruakura Farmers' Conference Week are being printed as

"Proceedings of the Ruakura Farmers' Conference Week 1954"

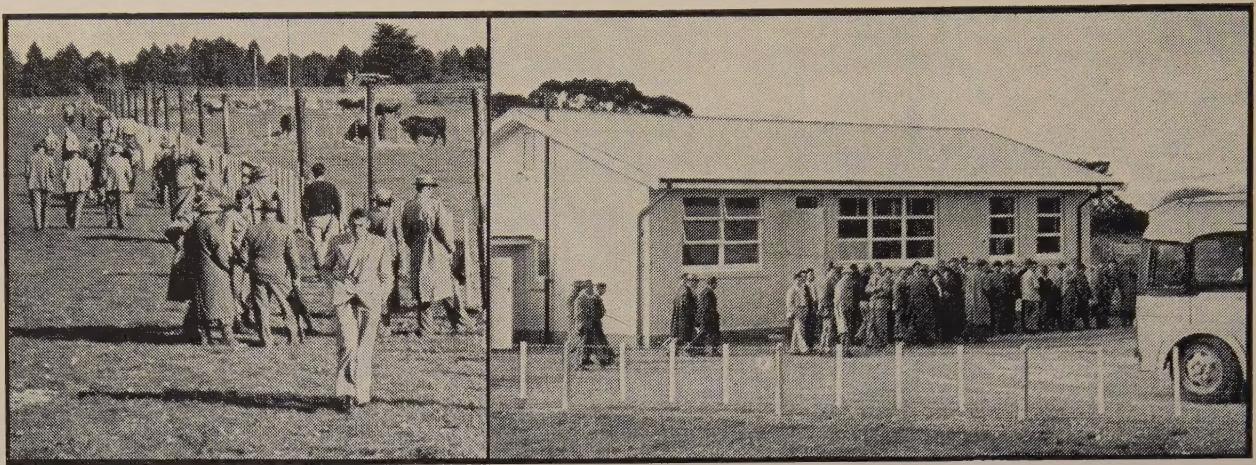
Price 10s., post free

Those who paid conference fees at Ruakura will be sent a copy. Others may order from the Department of Agriculture, Box 2298, Wellington. Copies of the "Proceedings" for 1950, 1951, and 1953 are still obtainable, price 10s., post free.

With this minor reservation, this year's field day was completely successful, and there was general agreement that apart from the crush at the dairy where the Ruakura milking machine was demonstrated, facilities for seeing the principal activities of the Station and of the Dairy Board's artificial breeding centre at Newstead were excellent. Visitors from all parts of the North Island and a few from even further afield were able to study closely the work at the Station and discuss with technical staff at each point problems in which they were interested. The Superintendent and his staff were generously congratulated on arrangements that enabled the conduct of so many



Upper—No. 1 dairy, where the prototype Ruakura milking machine was demonstrated, proved a clot in the bloodstream of the continuous bus service round the Station on the field day. Middle—D. S. M. Phillips (right) discussing the principles of the machine. Lower—A conference session at a Hamilton theatre.



Left—Next year's team of bulls to be used in the Dairy Board's artificial breeding service created great interest among dairy farmers. Right—The new laboratory and administration buildings of the Artificial Breeding Centre at Newstead.

people round the 870-acre Station and which also enabled a large number to visit the more recently acquired Hill Country Station in the afternoon, where impressive progress has been made in the special problems on hill-country stock management being studied there. The rapid progress made in the development of the 1400-acre hill-country area was also favourably commented on.

Demonstration Points

At the first stop, the woolshed, there were displays and demonstrations on how to lamb a ewe and on hogget rearing, and a nutritional study on autumn-saved grass as the key to pre-lambing feeding of the breeding ewe.

Particular interest in the second stopping place had been created by papers on the first day of the conference. At a previous conference Dr. McMeekan had delivered a provocative paper on how he would run his dairy farm, if he had one. This year in his opening paper "Recommended Techniques in Fat Lamb Farming" he set himself up on a hypothetical fat-lamb farm and showed how he would raise his carrying capacity with the objective of 250lb. of meat and 55lb. of fleece wool per acre. Miss D. E. Walker, following Dr. McMeekan with what she called the cold facts, gave a paper "Meat Production per Acre" which described a project carried out on three 50-acre farms stocked respectively at 4 ewes plus cattle, 6 ewes plus cattle, and 8 ewes per acre. Total meat and wool per acre on the respective farms were 259lb. and 43lb.; 259lb. and 61lb.; and 254lb. and 80lb. Miss Walker had a busy day discussing her project at the second stopping place, which was also the centre for the work on the use of crossbred calves for beef production, which was the subject of P. Radford's subsequent paper on "Producing Quality Beef from Dairy Stock". Miss Walker's work was also the subject of an excellent colour film "Grass to Meat" produced by the Station and shown at the conference.

No. 1 dairy, the third stop, where the prototype Ruakura milking machine was on display, was crowded all day and visited by many farmers on the remaining two days of the conference. About 900 dairy farmers heard a paper on the machine by D. S. M. Phillips on the last day of the conference.

Manufacture and Marketing of Ruakura Machine

THE terms of an agreement that has been reached for the manufacture and marketing of the Ruakura milking machine were announced to the Dairy Conference by the Minister of Agriculture, Mr. Holyoake, a fortnight ago. They appear on page 15 of this issue in an article describing the machine.

At the piggery, the fourth stop, pedigree pigs being used for crossbreeding and their crossbred progeny could be inspected. This work is being done at Ruakura in collaboration with the National Pig Council in the development of the national hybrid sow. D. M. Smith, who subsequently gave a paper on the work, said: "Give us two years and we will have something for you". A number of designs of the Ruakura round houses, with which a satisfactory design for prefabrication is being sought, created a great deal of interest here.

At the fifth stop, the fertility centre, work on artificial breeding and male and female sterility in dairy cattle was illustrated and bulls used in the work could be inspected. The business done by the cafeteria at this point showed that it is not only the stock that gets "a good bite" at Ruakura.

The New Zealand Dairy Board's Artificial Breeding Centre, Newstead, was the sixth stop. The new laboratories, from which 77 groups, with 1000 to 1100 cows in a group, will be serviced next year, were inspected by large crowds, as were next year's team of bulls.

The rearing of dairy stock, with particular emphasis on grazing management, was demonstrated at the No. 2 dairy, the seventh stop. Dr. McMeekan later gave a paper on the work demonstrated at this point, his address being followed by another Ruakura coloured film on this project, "The Grazing Management of Calves". Dr. McMeekan described this work more fully in his recent series of articles in the "Journal" which is to be reprinted as a bulletin. He summarised the results of his rearing system, which he described as foolproof, as: "No drenching; no deaths; no worries".

At the eighth stop, the No. 5 dairy, the size of cow and its importance in output of butterfat per acre and the early weaning of calves were demonstrated. The stock themselves and explanatory posters illustrated the work.

The use of identical twins in dairy cattle research was illustrated at the ninth stop, the No. 4 dairy, with some excellent poster displays. With identical twins the research worker can put one animal in two different places, thus ensuring that any differences are due entirely to environment. The effect of the level of nutrition on production and its importance in selecting dairy bulls were also demonstrated here.

Back at the staff centre hall at the starting place a map showing where molybdenum should be used in Raglan County and turves showing fertiliser responses amplified for local farmers a conference paper by Dr. I. J. Cunningham on "Molybdenum in Animal Health"; and a display by the Ruakura Soil Research Station on weed control was attended by F. B. Thompson, who later gave a paper on the subject.

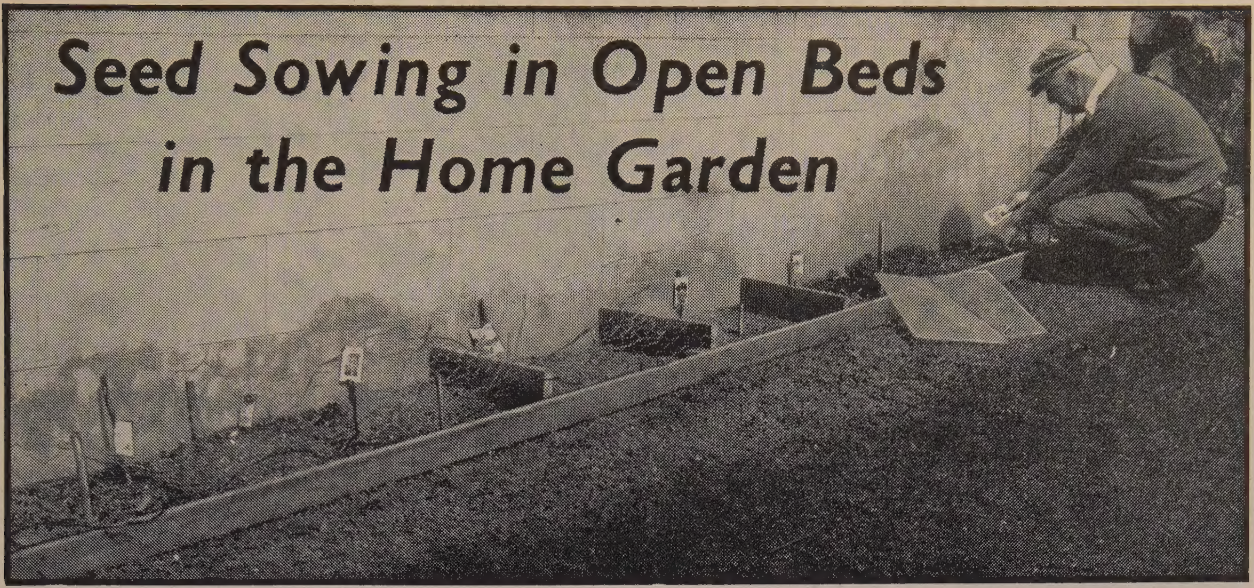
Farmer a Part of Research

In his opening address Dr. McMeekan told farmers: "We look forward to this week and to discussing with you our mutual job. It is an opportunity of learning from each other. We on the research side have to do our job as well as you on the practical side."

There seems little doubt that a type of conference has been evolved at Ruakura that appeals immensely to farmers, who are attending in larger numbers each year and taking part in the vigorous discussion with research workers that Dr. McMeekan considers essential to a successful conference.

All photographs by Fraser Niederer.

Seed Sowing in Open Beds in the Home Garden



DURING most of the year a large variety of vegetable seedlings can be raised successfully in beds in the open. Though it is preferable to grow seedlings in boxes in winter, gardeners will find that by paying careful attention to the selection of the site and preparation of open seed-beds, adverse weather can be largely overcome, thus extending the season when seedlings can be grown in this way. Advice on the sowing of seed in open beds and the planting out of seedlings is given in the first part of this article by J. S. Say, Horticulturist, Department of Agriculture, Auckland. The second section of the article, dealing with garden work during the month, is by W. G. Crawford, Horticultural Instructor, Department of Agriculture, Oamaru.

THE best position for sowing seed in the open is a warm, sunny one protected from wind and away from the drip of trees or overhanging eaves. A suitable situation can usually be found on the sunny side of a fence or hedge, though care will be necessary to stop the roots of the hedge coming up into the bed in search of moisture and a good food supply. This can be done by digging a trench between the bed and the hedge or by sinking a piece of corrugated iron or similar material into the ground.

The size of the beds depends, of course, on the number of seedlings to be raised, but it is advisable to limit the width to about 4ft. so that the centre can be reached easily from the sides to facilitate weeding and cultivation.

Importance of Good Drainage

Good drainage of the seed-bed is essential to have suitable conditions for germination. A badly drained bed is cold and poorly aerated. The drainage problem must be approached in two ways. In the first place the bed should be in a position which is not likely to be flooded or waterlogged and for this reason a seed-bed raised above the level of the surroundings is advisable. This can easily be done by using 6in. x 1in. boards attached to 3in. x 2in. corner pegs or, if something more permanent is needed, concrete or brick surrounds can be made. In the second place the soil in the beds should be in a physical condition which will drain quickly and easily even in the wettest weather and remain open and well aerated.

HEADING PHOTOGRAPH: Seed-beds made against a sunny wall are splendid for raising seedlings. Sparrow photo.

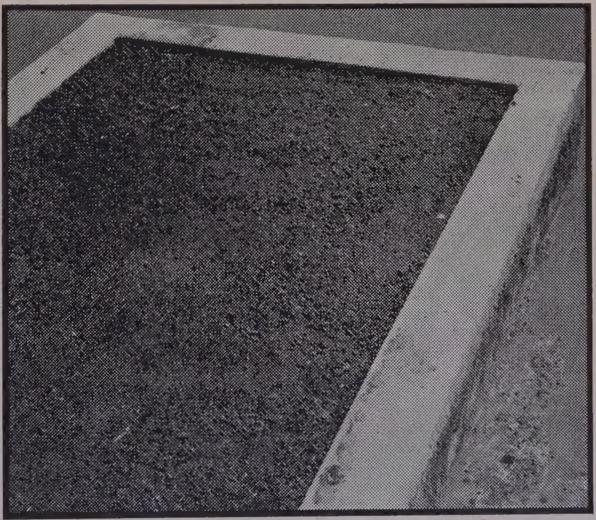
Thorough preparation is needed to get the soil in a suitable condition. After the bed has been dug over and the lumps have been broken up some well-decayed leafmould or compost passed through a ¼in. sieve should be worked in. If the soil is heavy, some coarse sand or fine gravel can be added at the same time. The compost serves a double purpose; by opening up the soil it promotes drainage and aeration and during dry weather it acts as a reservoir for moisture.

At the same time as the compost is worked in 1½oz. of lime and 3oz. of superphosphate to the square yard should be added. After this the bed should be lightly and evenly firmed by tramping and then raked out to a perfectly level surface and to a fine tilth.

Weeds are frequently troublesome in a seed-bed, but these can be lessened to some extent if the bed is prepared some weeks before it is needed. An occasional very light hoeing will kill the weeds off as they germinate, but care should be taken not to hoe deeply, as fresh seeds will be brought up from below.

Sowing the Seed

No matter how well the seed-bed has been prepared, good results cannot be obtained if good seed is not used. This is one of the essential conditions of good vegetable growing. It is always advisable to buy fresh seed each season, for some seed is very short lived even under ideal storage conditions, and attacks by weevils on stored seeds are also likely. It is important, too, to sow the variety most suitable to the season and to particular local conditions. Various strains of lettuce, cabbage, and cauliflowers have been developed to come to maturity at different times of the year. Little success will be had by sowing a summer lettuce in the early spring and it is not advisable to sow in the autumn the remains of a packet of cabbage left over from a summer sowing.



A raised seed-bed prepared for sowing.

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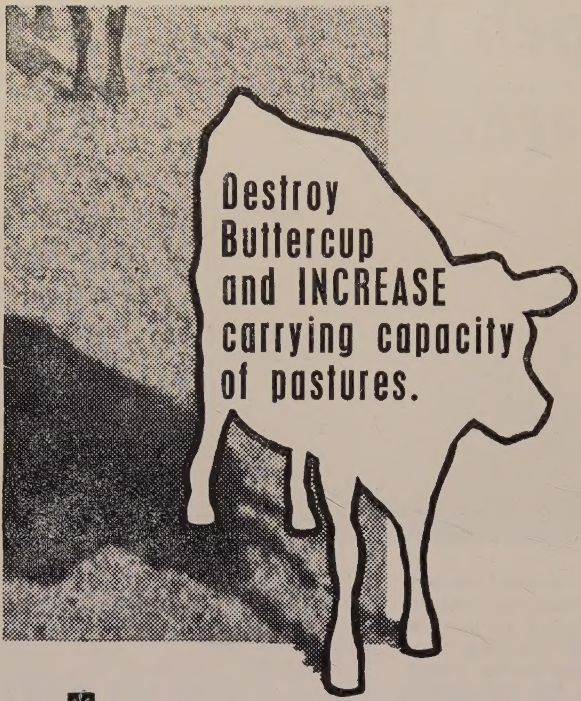

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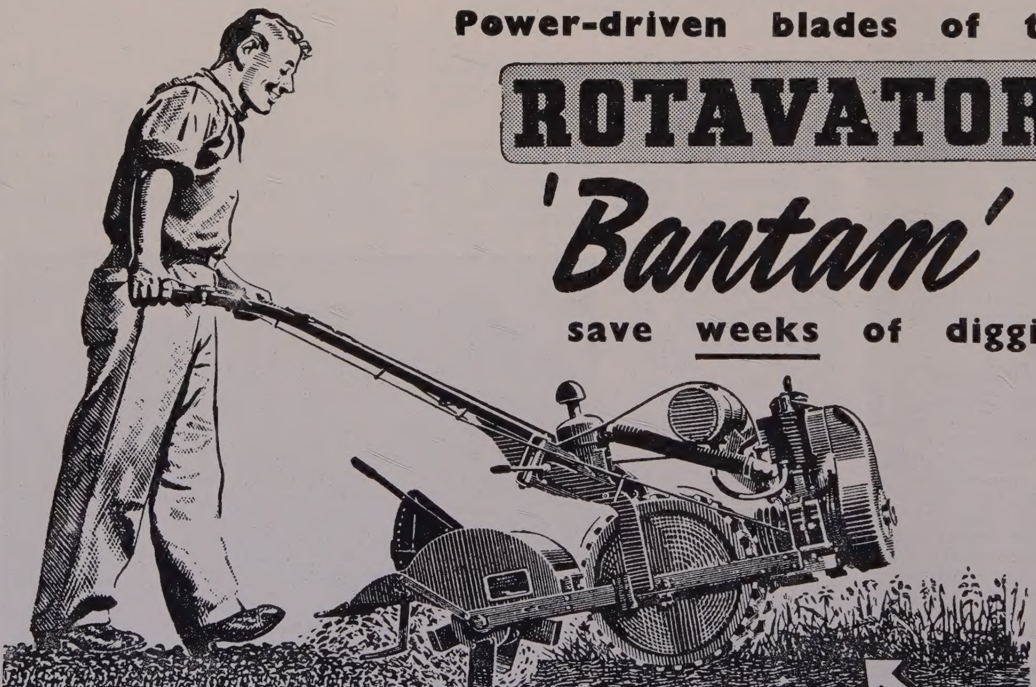

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Seed may be broadcast or sown in drills. Both methods have their advantages and the gardener should choose that which suits his particular requirements best. When seed is thinly broadcast over the bed or part of it the plants have more space in which to grow and do not tend to become leggy, but weeding is not quite as easy as when the seed is sown in drills. To sow in this way simply sprinkle the seed thinly over the prepared surface and very lightly rake it in or cover it with soil sieved through an ⅛in. sieve.

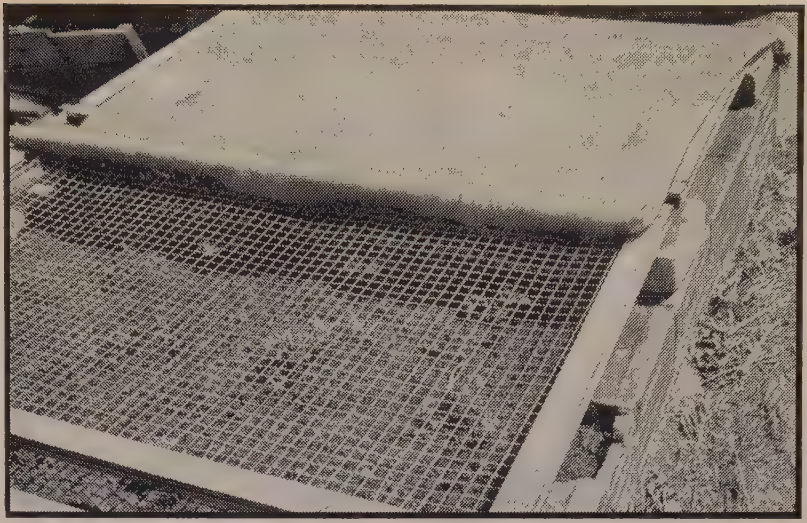
Though weeding and cultivation are easier when the seed is sown in drills, the seedlings are likely to become drawn and the roots very much intertwined, and as a result it will not be possible to lift the plants so easily when they are ready for planting out.

To sow seed in rows make a shallow drill about ½in. deep with the back edge of a rake or a pointed stick or by pressing the edge of a thin board into the soil. Sow the seed thinly by shaking it gently from the packet or by sprinkling it from the fingers. After sowing mark each end of the row with a stick, which should be labelled, and cover the seed by working the displaced soil back into the drill. Drills should be about 9in. apart.

Protecting the Beds

It is advisable to protect the beds after sowing from the sun and drying winds in summer and from the frost in winter. Screens made from 1in. x ¼in. wood laths nailed on to a frame at 1in. spacings or scrim drawn over a wire frame above the bed are ideal, but several less expensive yet serviceable substitutes can be used. Dried bracken is good and is best used by inserting the stems in the soil, leaving the fern about 6in. above the surface. Manuka brush spread over wire supports above the bed after the leaves have fallen is satisfactory.

Whatever system of protection is used, it will have to be removed as soon as germination takes place to prevent the seedlings from becoming drawn. However, during the summer it may be necessary to shade the beds during the hot part of the day and in winter protection from frost may be necessary. Scrim blinds on rollers are very satisfactory for this purpose, as they are convenient and easy to use.

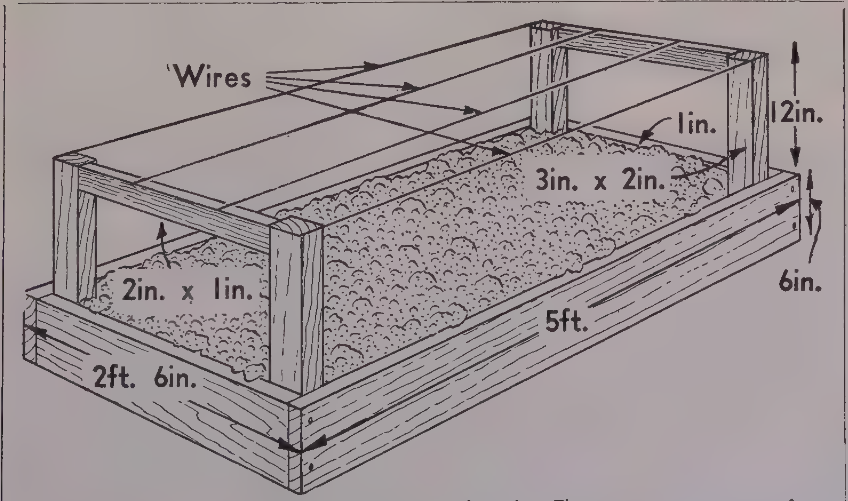


Netting frames covering a seed-bed give protection from birds and act as supports for scrim blinds which can be rolled on and off easily as required.

Birds are often troublesome in the seed-bed, as they like the fine soil as a dust bath and also relish some young seedlings. The shading over the beds will deter them, but after this has been removed protection with a piece of wire netting may have to be given.

As seed-beds dry out very quickly in dry spells during the summer, watering should not be neglected. Before germination and when the seedlings are small, a can is better, but later a hose can be used, provided care is taken not to wash out the soil or damage the plants with too much pressure.

Thinning is not usually necessary for broadcast seed unless the seed has been sown very thickly, but where the seed has been sown in drills it is advisable. This may seem wasteful, but unless seedlings have sufficient light and air, they will not develop into strong, stocky plants. As soon as the plants are large enough to handle all the weakest should be removed and 2 or 3 weeks later they should be thinned again if they seem too close together.



An easily made raised seed-bed of 6in. x 1in. boards. The corner pegs carry wires over which scrim blinds can be rolled.

Pricking out Seedlings

Though it is not practicable for the commercial grower, the home gardener would find it an advantage to prick out seedlings such as cabbage and cauliflowers into another bed. If this is done, the plants can be lifted when ready for planting out with a good ball of soil attached to the roots and they will go ahead with little check to growth.

The bed into which they will be pricked out should be prepared in the way described for seed sowing, with the addition of 3oz. of blood and bone to the square yard lightly forked in. The seedlings should be pricked out at 3in. x 3in. spacings. Shade will be necessary for the first few days after pricking out and this should be reduced until the plants can stand full sun.

Insect pests may be troublesome in the seed-bed. Cabbage and cauliflowers are very likely to be attacked by caterpillars and should be sprayed with arsenate of lead or D.D.T. Slugs and snails can be controlled with metaldehyde baits, but if the surroundings are kept free of weeds and rubbish, the trouble will be greatly reduced.

Plants should not be left too long in the seed-bed, for even those which have been pricked out deteriorate rapidly once they become crowded. As soon as the plants have become thoroughly established in the seed-bed growth is very rapid in the warmer periods of the year and the plants soon become weak and drawn.

Planting out

The position where the seedlings are to be planted should be given its preliminary preparation if possible well before the plants are ready to be set out. The bed will then have a chance to consolidate, and if bad weather intervenes, a rush to prepare the ground at the last minute is obviated.

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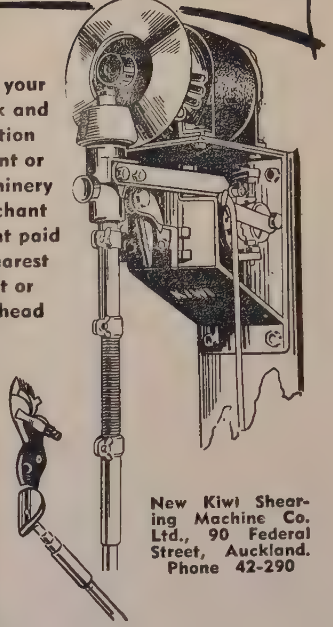

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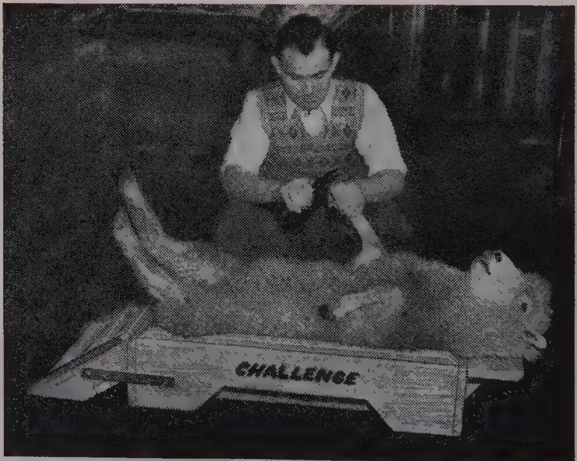

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raking the ground out to a moderately smooth and level surface. When the plants are ready it is then a simple matter to hoe in some fertiliser if it is needed and to rake the surface down to a fine tilth.

The best time to transplant seedlings from the seed-bed to the open ground, especially during the summer, is during dull, cloudy weather. Whenever possible planting should be avoided on sunny or windy days even if soil conditions are suitable. Planting should not be done when the soil is dry, cold, or excessively wet.

On hot, sunny days and in windy weather transpiration from the leaves is very fast and the seedlings will usually collapse as soon as they are set out and take a long time to recover. It is an advantage to shorten back the large leaves of cabbage and cauliflowers by about half if planting has to be done during such unfavourable conditions. If the weather is dry, the bed should be well watered the day before the plants are set out.

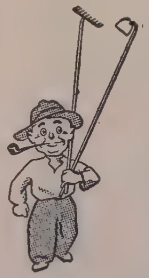
Plants which have been pricked out will lift with a good ball of soil attached to the roots and will transplant and become established with the minimum amount of trouble. Those which are lifted straight from the position in which they were sown will not lift as well, and frequently all soil is lost from the roots when the plants are separated. If this is so, more care must be taken with the planting out, which should be done during the most favourable weather and soil conditions. Watering is almost sure to be necessary until the plants become established unless there is a period of dull or wet weather.

Planting out with a trowel is to be preferred to planting with a dibble. With a trowel it is possible to make a hole of suitable size, to place the plant at its correct depth, and to fill the soil in without disturbing the roots. When a dibble is used there is always a tendency to force the roots into the hole, with the result that the ball of soil is broken and the longer roots are bent to an unnatural upward position.

[*Sparrow*

Cabbages and cauliflowers sown in rows. The seed was sown rather thickly, and better plants would have been obtained if they had been thinned at an early stage.

Work for August



There is a general tendency to begin sowing of seeds and setting out of plants too soon, and it is sound practice to delay sowing until the ground and the climatic conditions are suitable for good germination and plant growth. Three essential factors determine the germination of seed and the growth of plants—warmth, air, and moisture. It is much better therefore to delay sowing for 2 or 3 weeks after it is considered that the ground is in the right condition. Furthermore, many crops, carrots in particular, have a tendency to bolt to seed if they receive a check in the early stages of growth due to cold or wet conditions.

Green Crops

Land which has been sown in green crops should now be turned over. It is a common mistake for gardeners to bury green crops too deep. Such materials are broken down in the main by soil bacteria, and as the bacteria are more plentiful near the surface, the nearer the green crop can be kept to the top layer of soil the quicker decomposition will be. Provided the soil was dug deeply before it was sown down in cover crop, there is usually no need for other than a shallow digging the second time. All green crops should be properly decomposed in the soil before the land is used for sowing seed or setting out plants.

Liming of Ground

If no lime was applied in autumn, this may now be necessary, particularly for brassica crops. Most soils in New Zealand require a small dressing of lime every year or every second year to keep them sweet and in good heart. A suitable annual dressing per square yard for most vegetable soils is ¼lb. for light soils and ⅓lb. for heavy soils. This amount applies to high-grade carbonate of lime. If burnt lime is used, half this amount will suffice.

Preparation of Land

Ground which has been turned over before winter and left rough should be forked over lightly and broken down to a reasonably fine tilth in preparation for early sowing. Instead of sowing the ground immediately it should be allowed to stand for 2 or 3 weeks, giving young seedling weeds a chance to germinate. At the end of this period a cultivation on a hot sunny day with a well-sharpened hoe will destroy all weeds. This practice is well worth while and the ground should then be reraked and made ready for sowing out. The foundation is laid for the crop which follows by the preparation of the soil at the time of sowing.

Early Sowing

In the main seed should be sown thinly and evenly. Thin sowing usually results in plants being sturdier and healthier than with thick sowing. The depth to sow seeds of different kinds is usually given on the packets supplied by the seedsman, but this advice should be taken as a guide only. There are two principal factors which influence the depth of seed sowing. They are the soil type, that is, whether the

[*Sparrow*

Green crops should be turned under the ground now, but they should not be buried too deep.

[*Sparrow*

A small dressing of lime every year or second year will keep the soil sweet and in good heart.

soil is of a light sandy nature or whether the soil is of a heavy type, and the moisture content of the soil at the time of sowing or likely to be experienced for a few weeks after sowing. In light soils or on those likely to dry out readily seeds may be sown a little deeper, and on heavy soils slightly shallower than the depth recommended on the packet.

Sowings and Plantings

Potatoes: Early varieties can now be planted out in favoured localities and in particular on hill country where late frosts are less severe. Varieties which do well in the North Island include Arran Chief, Epicure, and Arran Banner and in the South Island Jersey Bennes and Epicure. Early potatoes should be planted above the surrounding level of the land, by placing the seed potatoes on the top of the soil and moulding up.

Cabbage: Sow seed of the Golden Acre, Enfield Market, or Copenhagen varieties.

Lettuce: Imperial 615 is a good variety for planting at this time of year.

Beetroot and turnips: Provided the soil is in a good condition, small sowings only should be made. Both of these vegetables have a habit of bolting to seed if the growing conditions are not good. Suitable varieties include:—

Beetroot: Detroit Dark Red.

Turnip: White Stone and Golden Ball.

Carrots: Unless the position is a very favoured one and the soil is in good condition and warm, sowing of carrots should be delayed until near the end of August when germination and early growth will be enhanced by better weather. A delay in sowing of 2 to 3 weeks at this time of the year means only a few days later at harvesting.

Radish, spinach, and spring onions: Small sowings only should be made in sunny, well sheltered positions. Varieties recommended include:—

Radish: French Breakfast and White Icicle.

Spinach: Prickly Seeded (a cold weather variety).

Spring onions: White Lisbon.

Tomatoes: Seed may be sown toward the end of the month, for planting out from mid-October. Sowings should be made in a raising frame or under glass and should be covered at night to protect the young seedling from frost damage.

Dwarf varieties: Adelaide Dwarf, Tatura Dwarf, and Stoners Dwarf.

Tall varieties: Moneymaker, Potentate, and Carters Sunrise.

Carters Sunrise and Moneymaker have done exceptionally well this season when grown in the open.

Plantings

Cabbage: Set out plants of Flower of Spring or Henderson's Early Market varieties. Golden Acre, Enfield Market, and Copenhagen varieties may follow later in the month.

Cauliflowers: To grow well cauliflowers should be given a favoured spot in the garden. Quick growth is essential for high-quality produce. Recommended varieties are Early London, Walcheren, All Year Round, and Southern Cross.

Onions: Transplants intended for the main crop for storing can be set out from now on. A variety proven for long keeping is Pukekohe Longkeeper. Early varieties are Ailsa Craig and Straw Spanish (Ebenezer).

Shallots: Shallots can be broken up and planted now. Planting is a simple operation, and the bulbs should merely be pressed on the top of the soil so that they will remain upright; rooting will start almost immediately. They should be set in rows 12in. apart with 8in. between the bulbs.

Rhubarb and asparagus: Rhubarb and asparagus may still be planted, but time is running short, and sets should be planted without delay. With rhubarb only the young pointed crowns on the outside of the parent plant should be used. Several good varieties are available, but only those which are known to have done well in the district should be planted. Proven varieties are Hortons Seedless, Victoria Giant, and Champion for main cropping and Topps Winter for a winter variety. The last-mentioned variety produces all the year round and if not cropped too hard will produce a good supply of well-coloured stalks during winter.

Suitable asparagus varieties for setting out at the end of the month include Mary Washington and Paradise.

Weed Control on Metal Paths and Driveways

TODAY effective chemicals are available for the control of weeds on metal paths and driveways. The chemicals may be used in several ways. In the first method light rates of contact chemicals are used, the rate being sufficient to kill annual and establishing perennial weeds but not adequate to eradicate deep-rooted weeds. Repeat applications of the contact chemicals are necessary to keep the areas free of weeds. Materials most suitable for this type of weed control are chemicals based on chlorates, but made safe to handle with the inclusion of fire-retardent materials. Proprietary lines are available as "Atlacide" and "Polyborchlorate". A 10 per cent. solution of these chemicals should be used to drench the weeds in a spell of dry weather.

Alternatively these chemicals plus chemicals based on borates such as "Borasin" and ordinary borax can be employed at high rates of application or at rates sufficiently high to cause soil sterilisation. If these chemicals are applied at 1lb. per square yard, death of most weeds is achieved and the areas may remain weed-free for up to 6 months. Subsequent light applications of the chemicals based on chlorate would ensure a kill of establishing weeds.

A new series of chemicals known as urea compounds have proved under New Zealand conditions to be many times more toxic than compounds based on chlorates and borates. These urea compounds (of which C.M.U. is an example) if applied at 80lb. per acre or 8lb. per square chain will give soil sterility which may last for several years. Complete kill of all vegetation for considerable periods can be obtained with urea compounds. They must be used with the same care as that taken with hormone weedkillers. Spray drift must be avoided, and if roots of shrubs and trees are growing in the area to be treated, there is a danger of killing the shrubs and trees. Urea compounds at high rates such as 80lb. per acre should be used only where complete destruction of all vegetation is desirable.

If the area is predominantly covered in grass such as Indian doub (*Cynodon dactylon*) or couch grass (*Agropyron repens*), T.C.A. can be effectively employed for the control of the grasses. A rate of 80 to 100lb. per acre is sufficient in most cases. Repeat applications may be necessary for complete eradication of more resistant grasses, such as *Paspalum dilatatum.*

—*A. A. DUNCAN, Instructor in Agriculture,*
Department of Agriculture, Wanganui

The Ruakura Milking Machine

By D. S. M. PHILLIPS, Physicist, Department of Agriculture Animal Research Station, Ruakura

AT the request of Federated Farmers a complete milking machine has been designed at Ruakura which incorporates the results of research on mechanical milking and makes use of the latest available techniques in engineering, rubberware, and cleaning methods. The machine combines maximum milking efficiency and stability of operation with mechanical simplicity and ease of cleaning.

THE Ruakura milking machine has been designed to meet three important requirements essential to effective mechanical milking. First, it provides a simple, trouble-free mechanical system which requires little maintenance and cannot get out of adjustment. Secondly, it provides the stability of vacuum level and regularity of pulsator action necessary to the cow if the let-down response is to be consistently good. And finally it incorporates a cleaning system which can maintain a satisfactory state of hygiene.

The improvements in design are based on careful laboratory work and were made possible by the accurate machine testing instruments and milk flow recording equipment designed at Ruakura. These have been used to determine weaknesses in current types of milking machines by extensive field testing and they have also been used for continuous checking of the Ruakura milking machine during its development.

Major Difficulties to be Overcome

The major difficulties to be overcome in machine operation were the following:—

1. Unstable Milking Vacuum

Unstable milking vacuum involves a number of aspects of design such as the provision of a sensitive and accurate vacuum regulator, elimination of air leaks in the plant, design of pulsation system to give minimum air consumption and staggered air demand, and layout of vacuum system in such a way as to minimise the effects of pulsating air-flow.

2. Faulty Operation of Releaser Systems

The faulty operation of releaser systems results in flooding of the milk line, churning of milk, and contamination of the air system. Field testing and subsequent laboratory investigations with the recording vacuum gauge showed that releaser flooding was extremely common and was due to various combinations of a number of faults in pulsator design and machine layout. The conditions necessary for correct operation were established readily from physical principles and were subsequently verified experimentally.

3. Irregular Bail Pulsator Operation

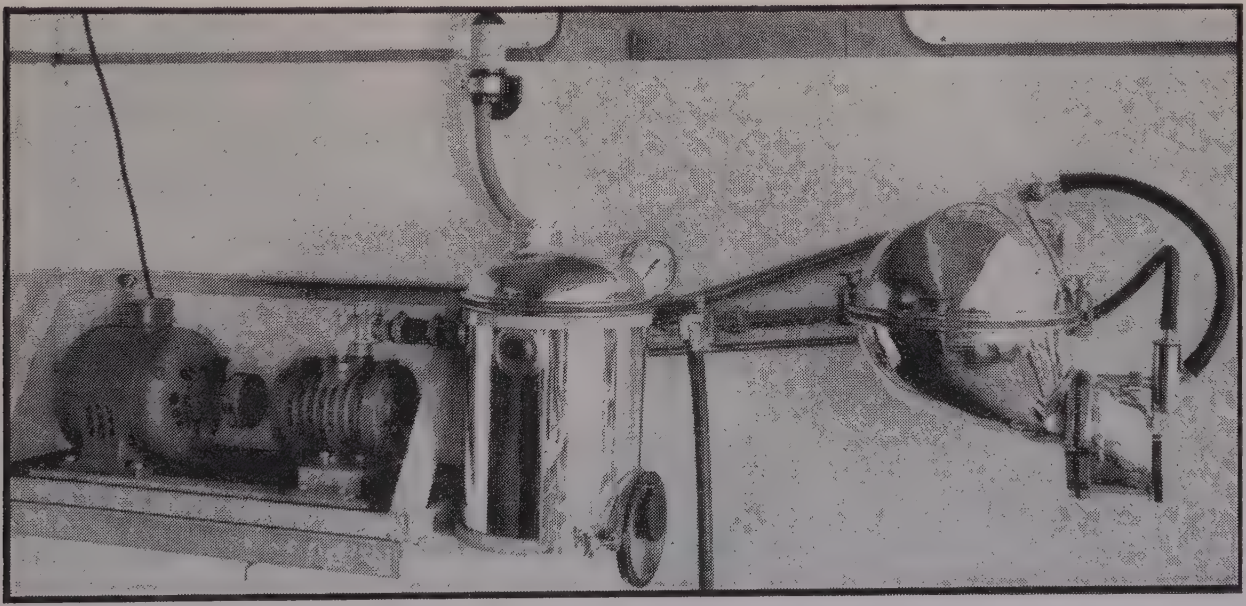
Field testing with the recording vacuum gauge showed that variations in rate, ratio, and nature of pulsation from bail to bail were very great and almost universal. This was due to the inability of the mechanical drive systems to maintain constant adjustment, incorrect design of pulsator ports, and variations in the staggering of pulsator air demand. Variations of this type have a detrimental effect on the cow's milking habits.

To overcome these three types of operational difficulties a system of pulsation was devised which provided flexibility in the placing of the releaser pulsator and also accurate control of pulsation throughout the shed. The pneumatic system employed satisfies all the required conditions and provides in addition a number of advantages in maintenance, installation, and cleaning.

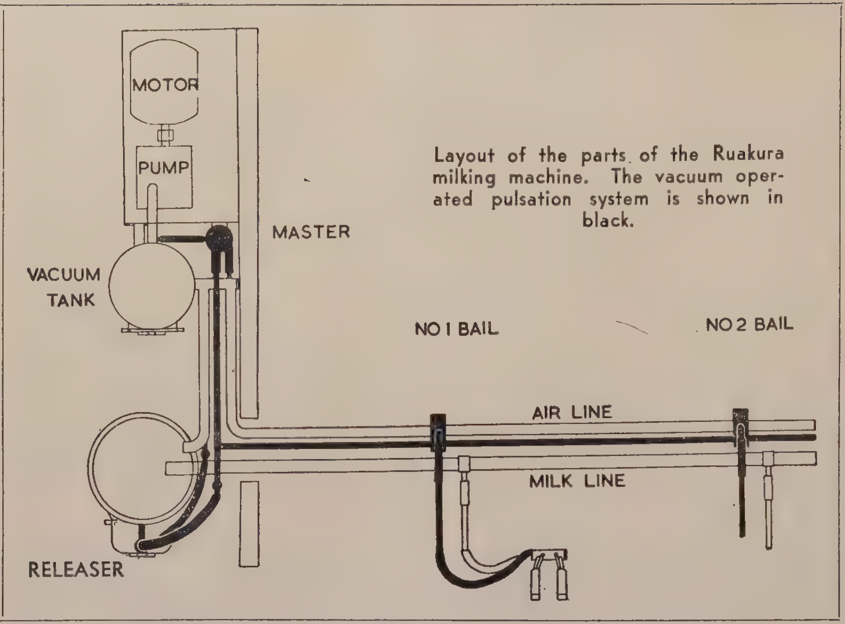
The **pulsation system**, briefly, consists of a "master timing" pulsator which is concerned only with timing control of rate and ratio. It is operated under optimum conditions of cleanliness and with no mechanical load. This master pulsator controls the bail and releaser pulsators, which are relay pulsators only, operating in exact synchronism with the master pulsator and thus with one another. The squeeze-release ratio is reversed alternately so that ideal staggering of the air demand is possible. The system is characterised by stability, regularity, simplicity, ease of maintenance, and hygiene.

The design of the plunger and sleeve system in the pulsators is very important in obtaining a long working life. In the design adopted, based on long periods of bench testing and careful analysis of the forces acting on the plunger, the elimination of unsymmetrical forces has made possible a very long useful life. It is also a design which lends itself to accurate manufacture, an essential if a long working life is to be obtained.

The faults of the **releaser system** have been cured by the use of a simplified unit system in which the releaser pulsator is mounted directly on the releaser. This gives the optimum conditions for vacuum balance and reduction of air flow paths. Such a releaser system is possible only with an unlubricated pulsator, and the pneumatic relay pulsator with its



The machine in the releaser room. The whole assembly is mounted on two brackets. The releaser with its pulsator is on the right; the recycling valve and cleaner inlet can be seen between releaser and vacuum tank. The master pulsator is partly visible above the vacuum tank lid. The vacuum tank has a fitting to take the releaser spit-chamber for automatic cleaning.



Layout of the parts of the Ruakura milking machine. The vacuum operated pulsation system is shown in black.

snappy action and accurate ratio is ideally suited to this operation.

The **vacuum stability** has been assured by the use of the Ruakura vacuum regulator and an ample reserve air level. Reduction in plant leaks has been achieved by the use of an improved type of coupling and the application of better quality rubber throughout the plant. In addition the reduction of air consumption in the bail and releaser pulsator systems by better teat-cup and releaser spit-chamber design has reduced the total machine air consumption, even though the pulsation system is operated from the vacuum system. The uniformity of pulsator staggering together with careful design of the air-flow system has also reduced vacuum variation.

Major Features

The machine has the following major features:—

1. General Design and Installation

The machine has been designed so that all parts requiring precision fitting are pre-assembled during manufacture. The services of a qualified fitter would not be required in assembly, and this coupled with the reduction in assembly time should reduce installation costs.

In general design the machine involves four major units, which are:—

(a) **Vacuum pump-motor-vacuum tank and master pulsator unit:** These are combined in a welded metal frame which is attached to the supporting wall of the dairy shed by six bolts. No other fitting is required. This type of layout uses direct drive of pump with consequent safety advantages.

(b) **Releaser and releaser pulsator unit:** This is mounted on a simple bracket bolted to the supporting wall. The whole releaser is removable. The top and bottom halves of the releaser are identical in shape to economise manufacture. The releaser spit-chamber has been designed to give the maximum amount of milk release for a minimum of air consumption, resulting in greater capacity and reduced air demand.

(c) **Bail mountings:** These consist of a single sliding mount in each bail mounted on an adjustable steel cross-bar. All pipes and pulsators slide into position in these mountings and require no fitting. The same mounting fits either left or right hand sheds.

(d) **Pipe and pulsator fittings:** Stainless steel piping is used with a new type of coupling in each bail length. This ensures an efficient and hygienic vacuum seal. Couplings are supplied fitted to one end of the pipe length. The free end is available for cutting to the precise length required in each shed. Milk nozzles and pulsators are mounted during manufacture so that the only shed fitting needed is cutting the pipes to correct lengths to fit the bails.

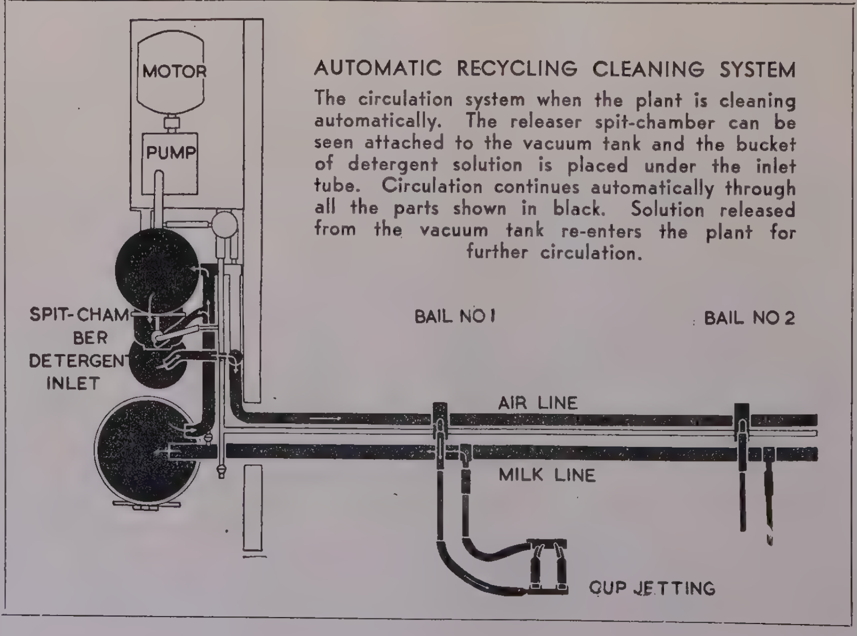
2. The Pulsator System

This operates entirely from the vacuum system, employing no mechanical drives. It is controlled by a vacuum-operated automatic "master pulsator" which provides the operating force for the releaser and bail pulsators. The use of this vacuum system eliminates the possibility of misalignment and loss of adjustment in pulsators due to movement of supporting members in the shed. The chance of faulty installation is also minimised. The system is thus characterised by marked stability.

(a) **Master pulsator:** This is a self-contained unit isolated from the rest of the system to eliminate contamination by milk or water. Essentially this is a "timing" pulsator. Its function is to provide accurate rate and ratio for the operation of the releaser and bail pulsators. This is a key feature, since all pulsators of the plant maintain an identical performance under master pulsator control. The unit requires no oiling or maintenance. It is supplied with a filter pad to prevent contamination with air-borne dust.

(b) **Releaser pulsator:** This is a small sleeve type pulsator in which the operating force necessary for movement of its plunger in both directions is provided from the master pulsator. The metal plunger is the only moving part and no lubrication is needed. It is mounted directly on the spit-chamber of the releaser so that all air-flow paths are as short as possible. This gives optimum conditions for releaser operation, eliminating releaser flooding with resultant poor milking and contamination of the vacuum system with milk. In addition, the use of this releaser pulsator enables the releaser to operate at a much greater capacity than is normally possible.

(c) **Bail pulsators:** These are almost identical with the releaser pulsator. No lubrication is needed. As in the case of the releaser pulsator, the vacuum system of operation of the plunger and sleeve makes it possible for cleaning solutions to be passed



AUTOMATIC RECYCLING CLEANING SYSTEM

The circulation system when the plant is cleaning automatically. The releaser spit-chamber can be seen attached to the vacuum tank and the bucket of detergent solution is placed under the inlet tube. Circulation continues automatically through all the parts shown in black. Solution released from the vacuum tank re-enters the plant for further circulation.

through it so that complete circulation of cleaning solutions throughout the machine is possible. Loading of the vacuum system is minimised by the use of a method which reverses the squeeze-release ratio, thus staggering the air demand. The pulsator ratio cannot vary. The rate is the same in all bails. During washing of the machine the pulsators operate as intermittent air admittors, providing ideal conditions of turbulence in the cleaning solution to assist in removing milk deposits.

3. Other Special Features

(a) **Claw piece:** The claw has been designed to present a surface with as few cavities and corners as possible. Nozzles are arranged so that all claw tubes butt against a metal surface, leaving no corners for the collection of dirt. These are of a redesigned automatic cut-off type so that folding over of the claw tubes is unnecessary when cups are being put on the cow. This cut-off eliminates excessive loss of vacuum should one or all of the teat-cups fall off the cow. The claw design also gives protection to the claw tubes at the nipple ends should a set of cups fall.

(b) **Sight glass:** The Ruakura milk-flow indicator—a device at present on the market—is used to time the milking process for individual cows. Entry to the milk line is through the back of the line, so that the rubber tubes used are of a minimum length with few bends.

Manufacture and Sale of Ruakura Milking Machine

THE agreement reached between Federated Farmers, the Dairy Machinery Traders' Association, and the National Dairy Association for the manufacture and sale of the Ruakura milking machine was announced by the Minister of Agriculture, Mr. Holyoake, to the Dairy Conference at the end of June. The provisions of the agreement are:—

1. Plans and specifications of the Ruakura milking machine to be handed to the National Dairy Association together with permits to manufacture under licence the parts protected by patent. These are: Bail and releaser pulsator, master pulsator, automatic cleaning system, including a jetting device for cleaning teat-cups.

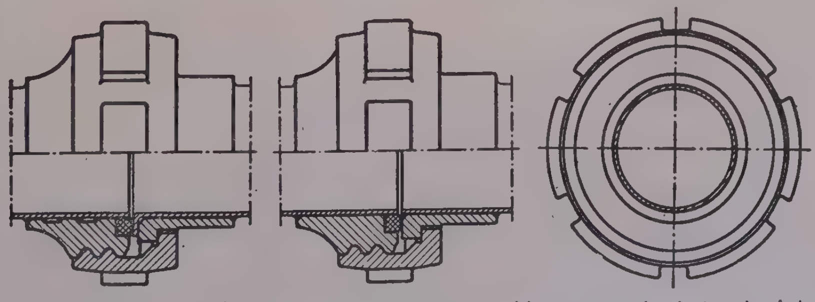
2. The National Dairy Association to undertake to have the Ruakura milking machine manufactured and to market it as far as possible through firms at present engaged in selling and servicing milking machines.

3. The National Dairy Association to sell component parts of the Ruakura milking machine to other milking machine manufacturers for incorporation in their machines.

4. The National Dairy Association to arrange for the sale of component parts of the Ruakura milking machine to dairy farmers as far as possible through firms at present selling milking machine parts.

5. The Department of Agriculture to publish a description of the Ruakura milking machine in the July issue of the "Journal of Agriculture". This will enable milking machine manufacturers to make and sell any of the unpatented parts of the Ruakura milking machine.

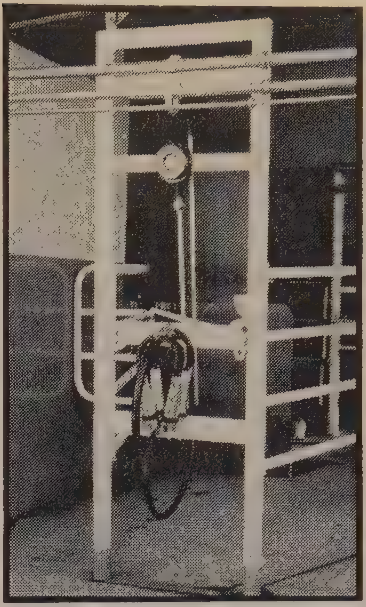
6. The Director-General of Agriculture to surrender all patents of component parts of the Ruakura milking machine on 31 December 1955. This will enable any milking machine manufacturer to make and market the whole Ruakura milking machine or any of its component parts after that date.



The Swedish pipe coupling using a square section rubber ring seal. It is adapted for use on brass or stainless steel pipe.

(c) **Vacuum control:** The Ruakura vacuum regulator is used to provide efficient vacuum control. This device has already become almost standard in the New Zealand dairy industry.

(d) **Rubberware:** As different parts of the plant are subjected to different conditions, the rubberware has been designed to provide the best available material at each point for each specific job. Thus, the inflations are made from a part-nitrile carbon black rubber with good flexing qualities, low fat absorption, and good resistance to knocking. The **tubing** of claw, milk, and air tubes is made from natural rubber reinforced with carbon black. This gives tough, long-wearing stock well suited to the type of wearing involved in a milking machine. The **rings** of releaser vacuum tank and pipe joints are square section nitrile rubber with high fat and stress ageing resistance. Such rings have a long reliable life and ensure a good seal at all times. The **flaps** of releaser and vacuum tank are of nitrile rubber moulded without metal inserts. These have low fat absorption with resultant reliable seating under all conditions. There are no crevices where rubber and metal meet. Under the difficult conditions inside the spit-chamber, where vacuum and atmospheric pressure alternate, it is almost impossible to ensure that a rubber-metal joint does not become contaminated and unhygienic. The all-rubber flap ensures satisfactory hygiene.



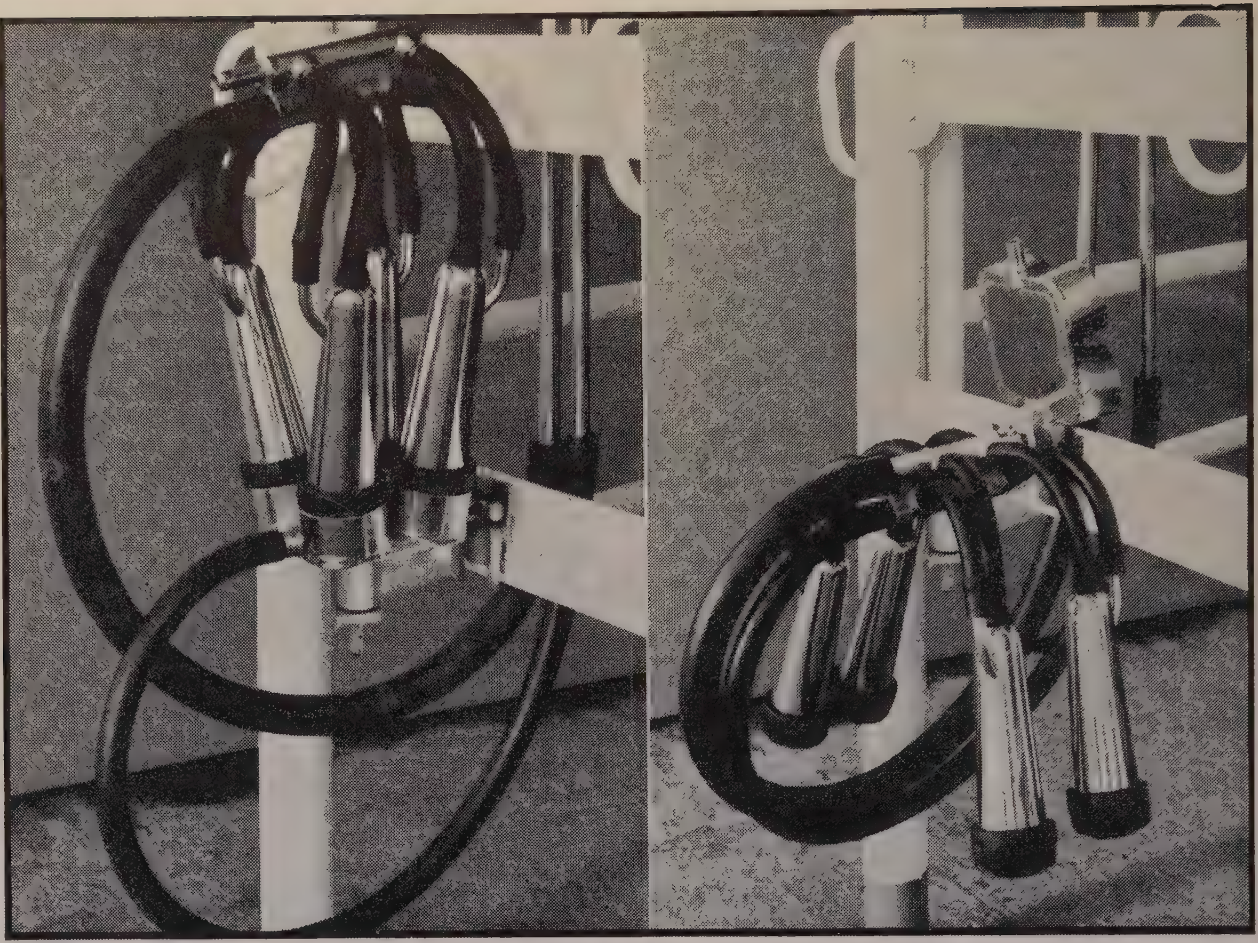
The simple bail layout of the Ruakura machine with the milk line at the top and the small pneumatic pulsator mounted on the air line and master pulsator line below. The teat-cups are in the jetting device ready for automatic cleaning.

It has been the general aim in the specifications for the rubberware on the machine that no components should have to be replaced during the working season. This rubberware should make a once-a-season service for milking machines eminently practical.

4. Automatic Cleaning

An automatic cleaning system is a key feature of the machine. This is made possible by the use of vacuum-operated pulsation and the installation of a special recycling valve by which continuous circulation of cleaning solutions throughout the machine can occur. The cleaning system consists of: (a) A special two-way valve in the air line to the vacuum tank; (b) an attachment on the vacuum tank to which the spit-chamber can be transferred from the releaser; and (c) a jetting device in each bail to which the teat-cups are fitted to permit complete recirculation cleaning.

In cleaning the machine the normal procedure is followed for rinsing the plant at the completion of milking. The teat-cups are then attached to the jetting device; the releaser spit-chamber is transferred to the vacuum tank; a bucket of hot detergent solution is drawn into the machine



Left—The teat-cups fitted into the jetting device so that detergent solution passing down the pulsator dropper will flow through the cups and claw in its circulation throughout the plant. Right—The teat-cups hung up in the automatic cut-off position on the claw-hook which is available when the jetting device is pushed to the vertical position. The improved claw and teat-cup design can also be seen.

through a tube attached to the two-way cycling valve when this is placed in the operating position. The solution reaches the teat-cup surfaces at a maximum temperature with maximum turbulence, cleaning the pulsators as it goes. It then fills the milk line and releaser, soaking the entire milk-handling system at a high temperature. Because the system is automatic, once the detergent is placed in the container supplying the plant it is practical to subject the plant to prolonged cleaning without any additional work by the operator. Since cleaning efficiency is a function of time multiplied by temperature, this automatic recycling provides an eminently practical solution to the cleaning of a milking machine. While recycling is going on the external parts of the teat-cups and claws are scrubbed and hosed of adhering faeces, milk, and dirt without any danger of contaminating the interior of the machine.

5. Conversion of Existing Milking Plants

The machine has been designed on a unit principle so that each part is an independent working unit suitable for use in converting older plants. Many machines in the industry are in such a condition that complete replacement is not necessarily economic. The types of conversions easily possible are as follows:—

(a) **Elimination of releaser flooding** by installation of a Ruakura releaser pulsator on the existing releaser. The pulsator in this case would operate from the existing releaser pulsator (which will be suitable as a controlling pulsator even though inefficient as a releaser pulsator).

(b) **Replacement of releaser** with the Ruakura releaser complete with releaser pulsator where the flap valves and releaser seals are in poor condition.

(c) **Replacement of vacuum tank** with one of the Ruakura type, or addition of the Ruakura spit-chamber mounting to the existing tank so that more efficient flushing of the plant can be carried out using currently recommended cleaning methods.

(d) **Replacement of releaser and bail pulsator systems** involving only the fitting of a new air line and the complete Ruakura pulsator system. The installation of the recycling valve and the bail jetting device would then enable such a converted plant to make use of the complete automatic cleaning process described.

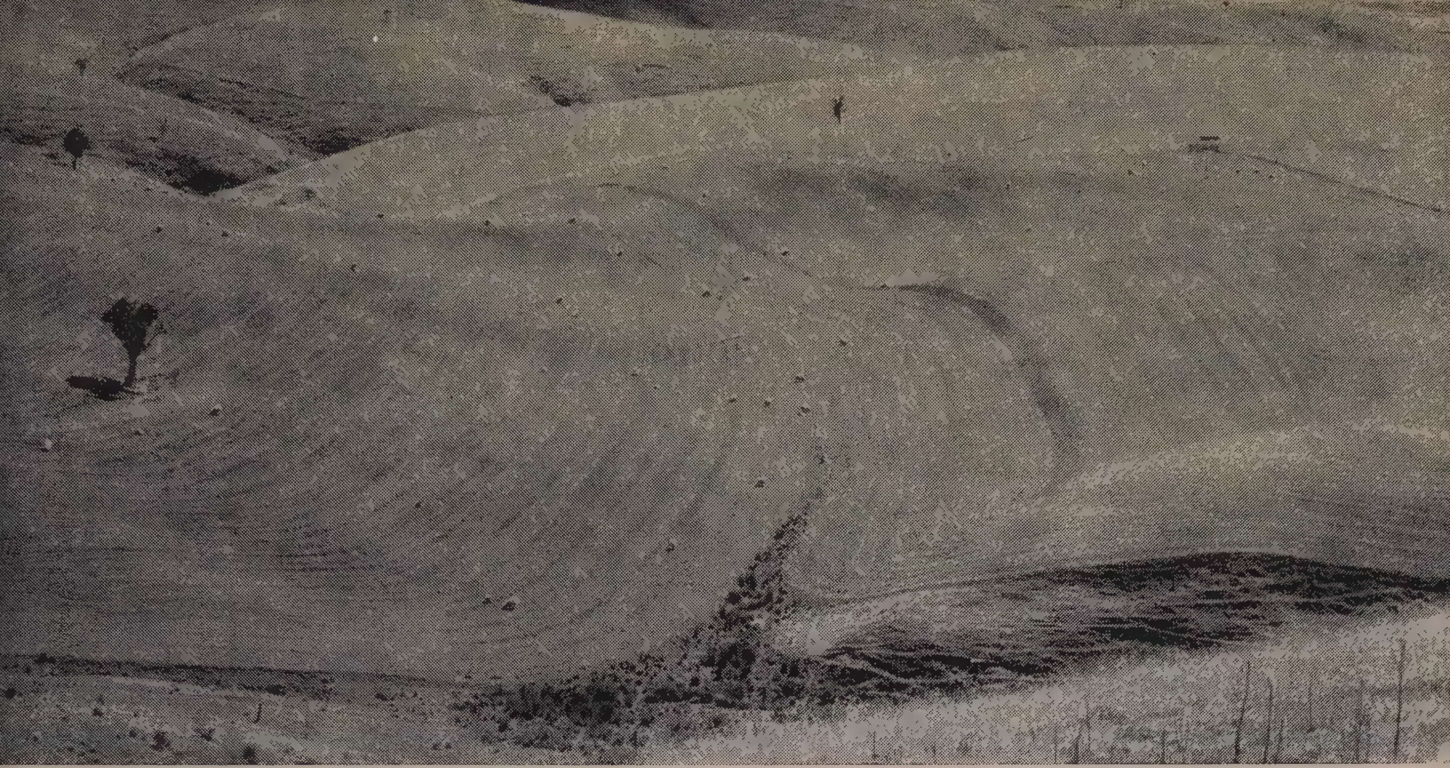
(e) **Other parts:** The Ruakura relief valve to maintain a suitable vacuum, the Ruakura milk-flow indicator to time the milking of individual cows, the Ruakura type claw and teat-cups, the Ruakura pump, motor, and tank assembly unit, and the Ruakura milking machine rubberware are all capable of addition to practically any existing machine.

All these conversions involve very little skilled work, since no mechanical drives are involved.

Finally, the machine has been designed with an eye to future additions which will increase its versatility. A number of additional fittings which will fit integrally into the present machine system are being developed at Ruakura.

Acknowledgment

Acknowledgment is made of the assistance of many members of the Ruakura staff, in particular Dr. W. G. Whittlestone for his work on the rubberware and the initiation of many new ideas on cleaning and design; to B. O. E. Calder for his work on testing and design of many parts; and to the workshop staff, particularly D. Sommerville, who was largely responsible for the engineering work.



HEADING PHOTOGRAPH: A young grass paddock in the foothills of the Kakanui Range at Marakoa. The darker strip near the centre of the photograph received no fertiliser and on this strip practically no grass or clover established. The remainder of the area was sown with molybdenum superphosphate and is a good sward of grass and clover.

Pasture Responses to Trace Elements

By P. B. LYNCH, Field Crop Experimentalist, Department of Agriculture, Wellington

WORK done by the Department of Agriculture in New Zealand with the application of 12 trace elements to pasture and lucerne is reviewed in this article, in which an assessment is made of the possibilities the elements offer of securing pasture responses on a variety of soil types. The rapid advances made in this subject in recent years have presented many lines of investigation that require urgent attention, including the important one of effects of some of the elements on stock health. An outline is given of a programme of future work that will strain limited staff and facilities, but that results to date indicate will be well worth while. The importance of adequate extension services to farmers in regard to the use of some of the elements, particularly molybdenum, the danger of the wrong use of which is very real, is stressed.

THE chemical elements that should be included under the term trace elements are difficult to define. In the absence of a clear definition the list given in the Imperial Bureau of Soil Science Technical Communication No. 39 "The Minor Elements of the Soil" (1) has been used: "The elements are arranged as follows: 1. Boron, manganese, copper, and zinc are apparently essential plant nutrients which are toxic in any but the smallest quantities; 2. iron, magnesium, and sulphur are minor classical nutrient elements; 3. deficiencies of iodine and cobalt affect animals, but not (so far as is known) plants; 4. selenium and molybdenum are toxic to animals when ingested from herbage; 5. thallium and chromium are abnormal soil constituents which may be the cause of certain disorders of plants."

The rapid advances that have been made in this subject in recent years have given a new conception concerning the place of molybdenum in the above list and have introduced more elements into the picture, such as vanadium. The place of sodium as a plant nutrient is an interesting one, and though it cannot definitely be classed as an "essential" plant nutrient, responses following its use have been secured on a wide variety of plants. If attention is restricted to those elements giving pasture responses, only classes 1 and 2 of the classification given before are of interest. To these, however, must be added molybdenum and sodium, and as vanadium, tungsten, and nickel have given pasture responses in recent trials in New Zealand, they also must be considered. The list of elements to deal with thus includes these five and boron, manganese, copper, zinc, iron, magnesium, and sulphur. This is a formidable array and any exhaustive treatment of each element cannot be contemplated in this article. Primarily, therefore, remarks will be restricted to work done with these materials in New Zealand on pasture and lucerne by the Department of Agriculture.

Progress of Research in New Zealand

Gypsum and salt were used before 1910 in some of the earliest trials with fertilisers in this country. Considerable interest was taken in the use of sulphur, particularly for lucerne, and an extensive series of experiments was conducted in 1928-30, mainly in Central Otago. About this time "White Island fertiliser" was being exploited commercially and this sulphur fertiliser was included in a number of trials in the North Island. Research into the control of bush sickness of sheep and cattle began at Mamaku in 1912, though investigations had been proceeding for some years before.

This work (2) caused attention to be given to the use of various compounds of iron, including limonite, and much experimental work was carried out both by the topdressing of pastures with compounds containing iron and by the use of stock licks and drenches for the control of the disease. This interest in iron compounds for pasture topdressing practically disappeared with the discovery (3), about 1935, that cobalt was the active element in the control of bush sickness.

At this period interest was being taken in the use of borax (4) in the control of brown heart of swedes and turnips and in the use of boron compounds in the manuring of apples. The mid-1930s marked the beginning of intensive research into trace elements and their effect on plant and animal

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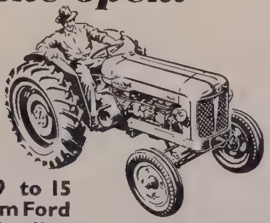

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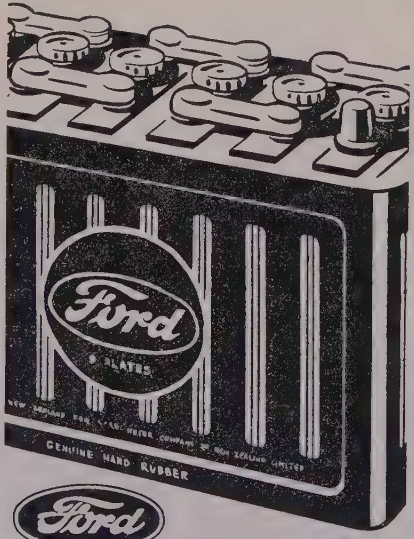
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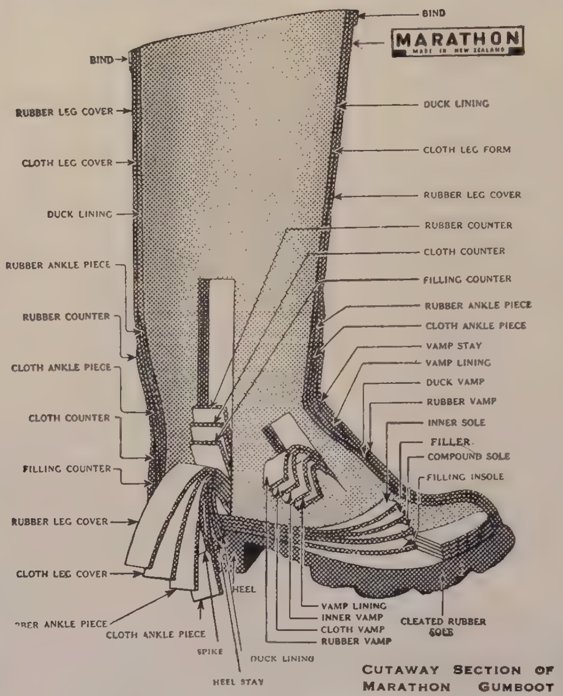
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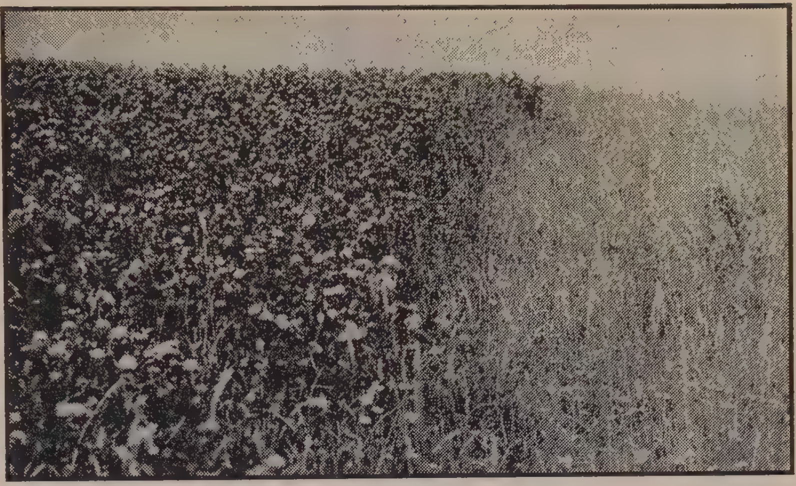

[*Robertson*

The remarkable effect of applications of sodium molybdate to a clover field in a molybdenum-deficient region is shown by comparison of the dense clover growth in the treated area at left with the clover-deficient sward at right.

production in New Zealand. Possibly the most significant discoveries since that time have been those of copper deficiency by Cunningham (5) (6) and of molybdenum deficiency by Davies (7).

Cunningham's work is of main interest in the field of animal health, but Davies's discovery, which was followed by extensive investigations by a team of research workers, has proved to be of immense practical significance in plant nutrition.

Since the war farmers and research workers alike have been impressed by the potentialities of this field of research; so much so, in fact, that it has been necessary not to stimulate interest but rather to preserve a balanced outlook which will keep trace elements in their proper perspective in relation to other fields of agricultural research.

Effects of Trace Elements on Pastures

In this work one is very conscious of the fact that much basic information is lacking and that the problem is being tackled in a very superficial way. But there is no other way to proceed. Data are inadequate concerning the role of these nutrients in plant physiology and their interaction with the different soil elements and with one another, and indeed very little is known of the whole soil : plant : environment complex which affects the results observed. Despite this, however, it has been possible to make advances of great practical significance, though only a very imperfect idea can be formed of the reasons for the results obtained. In the following discussion of each element in turn no attempt can therefore be made to explain the reasons for the responses obtained. The classification stage which must be completed before it is wise to form theories is only beginning.

Types of Trial Discussed

The results to be described have been secured from a relatively small number of mowing trials on pasture and lucerne and a large number of observational trials. Occasionally production cuts are taken on some of the observational trials and in some of the trials conducted in the early 1930s yields of hay were used as measures of treatment responses. Essentially, however, the observational trials are not adequately replicated. Their layout permits ease of observation and not the statistical analysis of results. The Extension Division of the Department of Agriculture has had long experience with the observational method, however, and is prepared to place, with certain reservations, a high degree of confidence in the results obtained. The coverage of soil types and farming practices which is required in soil fertility studies of this type could be secured only by large numbers of observational trials.

The pasture mowing trials are for the most part adequately replicated small-plot trials giving figures capable of statistical analysis. In recent years the technique most commonly used has been "mowings and clippings returned" (8). Such trials are used to keep a check on the results of observational trials and to conduct certain types of investigation for which the observational method is unsuitable. Stock grazing trials are also used whenever there is reason to suspect that effects on animal health and production do not closely follow differences in pasture production. From all types of trial, mowing and observational, soil samples are taken for chemical analysis, the soil types (9) of the trials are carefully checked, and pasture composition changes (botanical and, occasionally, chemical) are recorded.

Molybdenum

Without a doubt molybdenum must be considered the most important of the trace elements in New Zealand if these are arranged according to their immediate practical significance in agriculture.

Davies (7) first demonstrated molybdenum deficiency in New Zealand in 1945, though Anderson (10) (11) and others had shown molybdenum deficiency in South Australia and Tasmania before this. Pasture responses to molybdenum topdressing in New Zealand were reported in 1951 (12), though investigations had begun in 1945 in Northland, where small responses were obtained on "ironstone" soil in addition to those from lime, superphosphate, and potash. By 1951, however, outstanding field responses to molybdenum had been secured in various parts of Otago and Southland, and intensive investigations on molybdenum-deficient soil were in progress at the Invermay Research Station, Mosgiel.

The results from some 600 observational trials and 18 mowing trials can now be summarised. A large number of molybdenum-responsive soil types have been found. The largest area of highly responsive soils occurs in the South Island among the damp and wet coastal yellow-grey earths of the Balclutha-Gore, Taieri, North Otago, and South Canterbury districts. These are soil types of the downs country of low original fertility. Pastures north of Auckland on much hill and rolling country formed from sandstone and on certain soils derived from andesitic or doleritic rock have also given marked responses. All these soils respond to heavy liming.

On some areas, such as the fertile "downs" country of North Otago and South Canterbury (the dry coastal yellow grey earths) and on a number of soils of the Canterbury and Wairau Plains, only a slight deficiency occurs, and though lucerne may respond to molybdenum, pastures rarely show benefit from such application. Responses have been obtained on hill soils derived from greywacke and associated sedimentary rocks in the Marlborough Sounds and Wellington area and north of Auckland.

In the South Island it appears that weakly weathered and weakly leached soils rarely respond to molybdenum. With increased leaching and increased acidity, however, responses may become outstanding. In the North Island, on the other hand, good responses have been secured on strongly weathered soil derived from sandstone, and the degree of leaching seems to have little effect on responses. Mature podzols in both islands do not show responses, though an exception is the Te Kopuru sand at Dargaville.

The interaction of soil acidity (pH), liming history, and molybdenum responses is being studied in many trials. On unlimed soils of the wet coastal yellow-grey earths of Otago molybdenum alone at soil reactions of pH 6.2 to 6.5 has given results equal to or better than heavy dressings of lime, whereas under more acid conditions lime plus molybdenum usually gives better responses than molybdenum alone.

On other soils the lime : molybdenum interaction is not straightforward and it is not possible to say at what pH, with molybdenum applied, further liming is unnecessary. In some hill country, particularly in the North Island, where liming is impracticable, good results have followed the use of molybdenum without lime, provided sufficient phosphatic fertiliser is applied.

At the Invermay Research Station good pasture responses have followed

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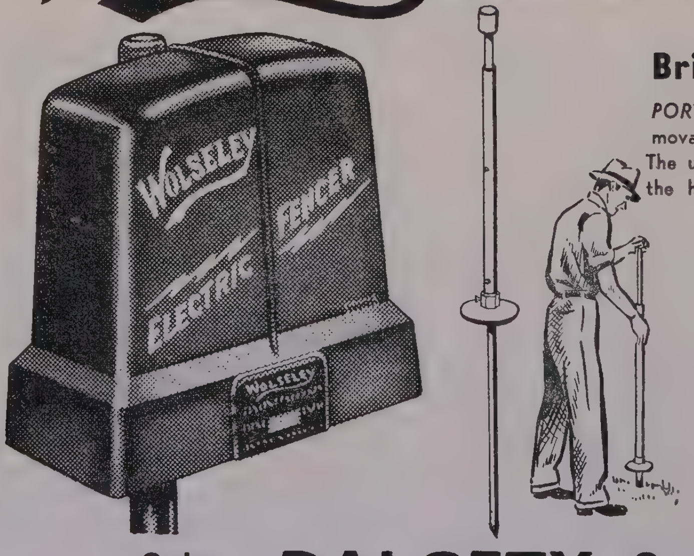

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The contrast between a plot treated with phosphate but not sulphur (left) and one treated with sodium thiosulphate in a North Otago trial. Dense clover growth followed the application of the sulphur-containing material.

an application of 1/16oz. of sodium molybdate per acre, but 1oz. per acre seems to be the minimum required for best results. However, some North Otago soils require heavier applications. On some soils, such as those of the Marton Experimental Area (yellow-grey loams), 2½oz. per acre of sodium molybdate has given responses lasting only 3 months or less, and in such areas trials with higher and more frequent applications are being laid down. However, until it is certain that these heavier dressings could not be detrimental to animal health, their field use could not be advocated. On the Invermay soils, on the other hand, the effects of a single dressing of molybdenum have lasted for more than 2 years.

The effect on animal health of molybdenum applications to pasture has been studied in co-operation with the Animal Research Division. A grazing trial with both sheep and cattle has been begun at the Invermay Research Station, and pasture samples from all trials have been analysed for molybdenum and copper levels. The recommended rate of 2½oz. of sodium molybdate per acre will generally not cause an increase of molybdenum in the herbage to toxic levels.

Cunningham (13) has, however, located certain areas where copper deficiency already exists, and where molybdenum dressings would be likely to intensify the trouble, as well as a number of soils where pastures are already moderate or high in molybdenum. Soils in both of these categories should not be dressed with molybdenum.

In the first category, that is, soils where pasture copper levels are low, are most peats and soils with mixtures of peat as well as Himitangi sand, Foxton sand, Marsden sand, and Te Kopuru sand soil types; in the South Island, soils of the Glasnevin series and Lismore silt loam are also included. Peats are both low in copper and high in molybdenum at least in the initial stages of development. In the second category Cunningham has found pastures with high molybdenum levels (above 10 parts per million) on Taupo ash soils near Wairoa. Pastures with moderate to high molybdenum levels (3 to 10 parts per million) were found on Rotomahana sandy loam, Waikakahi silt loam, Tihoi sand, Whakatane gravelly sandy loam, Whangamata sandy loam, sandstones and mudstones in the Wairoa and Raetihi districts, soils of the Waikari, Omihi, and Onepunga series, Harihari fine sandy loam, Taitapu sandy loam, Huihui sandy loam, Motukarara weakly saline sandy loam, and Weka clay loam. Most marine silts and some soils in the Raglan district carry pastures with moderate or high molybdenum levels.

On none of these soil types should molybdenum applications be made because of the danger to stock health. Cunningham stresses, however, that, apart from peats, these are tentative recommendations based only on a few pasture samples from each soil type. Pastures on peats and peaty soils, however, have been thoroughly investigated, and on no account should molybdenum be applied to such soils.

Striking responses in pasture growth have been obtained from molybdenum applications; on the other hand is pasture with molybdenum content approaching toxic levels. Molybdenum is not a safe fertiliser and the danger to stock health from its application to the wrong soil types or from too heavy or too frequent dressings is very real. Fully informed and adequate extension services to the farmer are essential if maximum use is to be made of molybdenum in agriculture in New Zealand.

Sulphur

Interest in the use of sulphur in agriculture in New Zealand dates from at least 40 years ago, though the main interest at that time seems to have been the correction of alkali soils. During the years 1928-30 an extensive series of trials was conducted with sulphur and gypsum in Central Otago, mainly on lucerne, and at that time the sulphur-bearing "White Island fertiliser" was included in many experiments in the North Island. From then until recently only occasional interest was taken in the use of sulphur and sulphates, but with the threat of a world sulphur shortage in the last few years and with the development of sulphur-free phosphatic fertilisers a new interest has been taken in the sulphur requirements of New Zealand soils.

Anderson (14) discusses sulphur deficiencies in Australia. He describes areas where sulphur deficiency occurs without phosphorus deficiency and others where both sulphur and phosphorus are deficient. The "tarry" soils (Waiareka complex) of North Otago fall into the first class. On these soils Lobb (15) has demonstrated outstanding sulphur and sulphate responses on pasture. These soils give very high figures for available phosphorus, yet show marked responses to superphosphate. Lobb showed that it was the calcium sulphate content of the superphosphate which was responsible for the results obtained.

On lucerne in Central Otago in the years 1928 to 1934, 13 out of 17 trials gave definite sulphur responses, as did 6 pasture trials in Southland in 1928. Sulphur responses have been secured in 2 recent trials in Central Otago. The soils showing responses in North Otago include, as well as the Waiareka complex, the Timaru silt loam and the Kauru silt loam of the "downs" country of relatively low rainfall (the Timaru soils being the more fertile) and the lime-rich soil Oamaru silt loam.

One of the most extensive areas of sulphur-deficient country appears to be the Canterbury foothill country and some of the high country as well. Some Canterbury Plains soils have also shown sulphur responses, especially on

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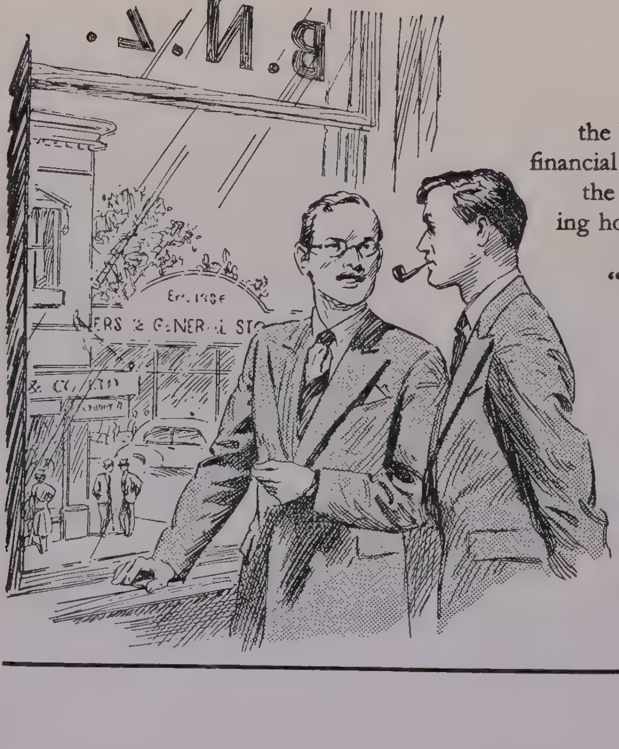

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lucerne. On these soils superphosphate gives better responses than other phosphatic fertilisers and is probably the best fertiliser to use, but on the phosphate-rich "tar" soils of North Otago sulphur, gypsum, or some cheap sulphate compound might prove more economical to use than superphosphate.

In the North Island responsive soils appear to be more limited in extent, but this may be due to the more extensive use of superphosphate in the past. However, some marked responses have been secured, such as those at Te Teko on Tarawera gravel and at Rangiwahia on a hilly yellow-brown loam soil of the Takapau suite. At the Marton Experimental Area on Marton loam, a yellow-grey loam, a short-lived but significant response to sulphur was measured, though trials over several years failed to show differences in yield between superphosphate and sulphur-free double superphosphate applied at equal rates of phosphoric acid content per acre.

No comprehensive survey of the sulphur responses of pastures on the soils of New Zealand has yet been attempted, but from the evidence accumulated to date there is no doubt that this is urgently needed.

Copper

Discoveries of copper deficiencies in New Zealand soils have been made by the animal research worker. Experiments have shown that livestock show copper deficiency symptoms when plant copper levels still appear to be adequate for normal pasture growth. Cunningham (5) (6) (12) has defined several areas where pasture copper levels are frequently deficient for stock; these include most peats and peaty soils, many sands, and in the South Island soils of the Glasnevin series and Lismore silt loam, a Canterbury Plains soil. This copper deficiency is aggravated if stock graze molybdenum-rich herbage.

Pasture responses to copper dressings are, however, not at all common in New Zealand. McLachlan (16) and Rossiter (17) discuss some of the copper responses secured on acid and sandy soils in Australia, but nothing as marked as these results has been secured in this country. Cunningham and Perrin (5) describe copper responses they have observed on pastures on peat soils at Waitakaruru, but of 8 Extension Division trials on peat only one has shown a response. Of 10 trials on a range of other soil types only one gave a definite response to copper, this being on Te Kopuru sand.

Copper responses on market garden crops have been obtained on peat at the Rukuhia Soil Research Station and on onions on peat at Marshland, near Christchurch, by Adams (18), but many crops seem more responsive to copper than do pasture species. However, it is possible that topdressings of copper sulphate on peats and sands for the correction of nutrient deficiencies of stock may in certain cases also be of benefit to pastures.

Boron

The widespread occurrence throughout New Zealand of the deficiency disease brown heart of swedes and turnips (4), which is known to respond to borax applications, would suggest the need for borax applications to pasture and lucerne on many soils. Wright and Gridley (19), working with mustard growing in Wharekohe silt loam, secured definite responses to boron in pot trials. Some 30 field trials on pasture on this and other soils have, however, failed to show responses to borax applications. In 2 other trials slight responses were secured, one being on Ketu silt loam in Pelorus Sound and one in a trial in Central Otago.

In 3 out of 4 mowing trials significant depressions in pasture production have followed borax applications, and these were trials at Dargaville on Te Kopuru sand, at the Marton Experimental Area for 2 months after topdressing, and at the Invermay Research Station for a year after the borax treatment was applied. No doubt the 56lb. per acre of borax topdressed did exert a temporary toxic effect at Marton, but at Invermay this significant depression from borax appears, on present indications, to be much more lasting.

Lucerne seems more responsive to boron than does pasture; 6 trials out of 28 have given responses, these being quite marked in 3 trials on Central Otago soils, one at Fairhall, Blenheim, on Omaka gravelly loam, and one in North Otago on Kauru silt loam. A more complete survey of the effect of borax on lucerne would be well worth while. The Central Otago district would be the most promising area in which to begin such an investigation.

Magnesium

Considerable interest has been shown in New Zealand in magnesium compounds as fertilisers since the first indications of promising results from serpentine superphosphate. No satisfactory explanation has been forthcoming of the reasons why serpentine superphosphate has given such good results on certain soils, but one suggestion has been that its magnesium content might be playing a part. Of some 50 trials on pasture which included magnesium sulphate responses were recorded in 6 trials only, 5 of them being in the Waihi district on Waihi sandy loam. This is an ash soil in the yellow-brown loam group which is highly responsive to potash. In many trials at Waihi serpentine superphosphate has given better results than superphosphate when applied at equal rates of phosphate per acre. It is, however, possible that the responses to magnesium sulphate may have been due to sulphur rather than to magnesium.

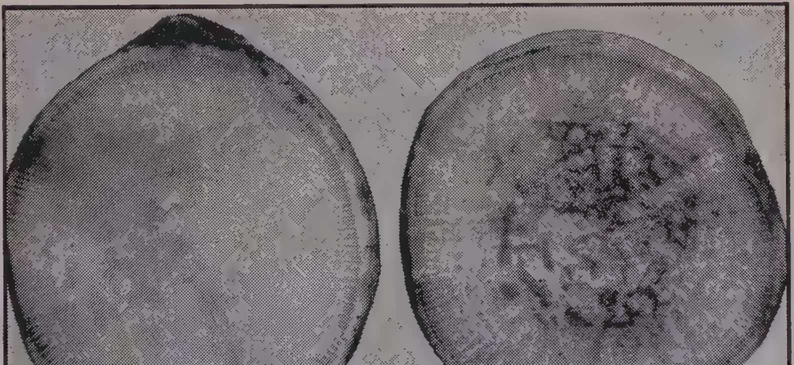
Another series of some 29 trials included a treatment of ground serpentine rock at 1 ton per acre; 7 of these trials showed some response to this treatment. Two of these 7 trials were on yellow-brown loams, two on brown granular clays, one on Te Kopuru sand podzol, and one on Hihi gravelly clay, a mature red-brown loam soil. In 3 of these trials serpentine superphosphate gave better responses than superphosphate.

More recent trials have included one on Ketu silt loam in Pelorous Sound, where a fairly good response was secured with magnesium carbonate. Mowing trials with this compound are in progress at the Marton Experimental Area (on Marton loam), at Invermay Research Station (on Warepa-like silt loam), and at Hindon (on Wehenga silt loam, a yellow-brown earth) with no effect on yield from magnesium.

At this stage, therefore, it is not possible to select any soil type which is likely to show magnesium responses, though a possible exception is Waihi sandy loam. According to overseas literature (1), magnesium deficiency is more likely on acid, sandy soils. Te Kopuru sand is certainly in this category. The pH of two of the Waihi trials giving responses was 5.3 and 5.7 (those of other trials are not available), and it might be worth while investigating magnesium responses on soils of an acid, sandy nature rather more thoroughly than has been done to date.

Sodium

Harmer and others (20) place lucerne and white clover in categories where slight to medium responses to sodium chloride (common salt) may be expected where the potash supply



Brown heart or mottled heart in swedes is caused by boron deficiency. The swede on the right is affected and that on the left is healthy.

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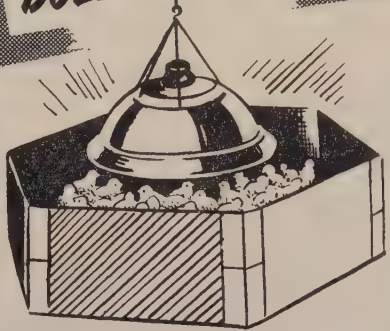

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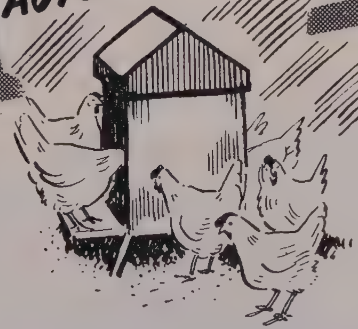

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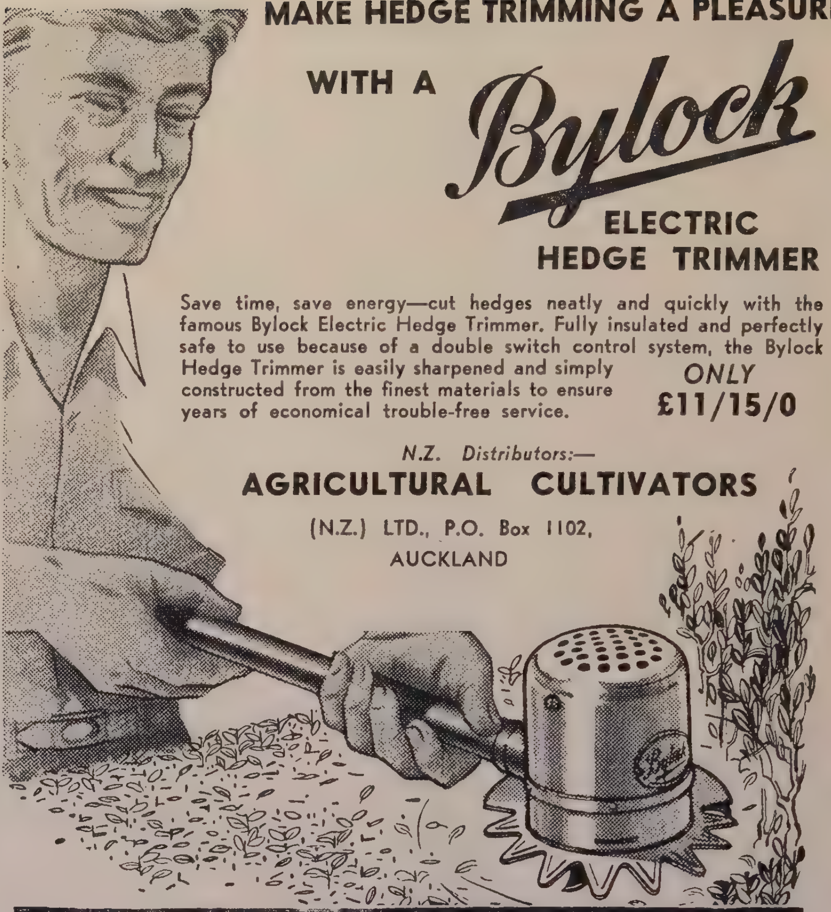

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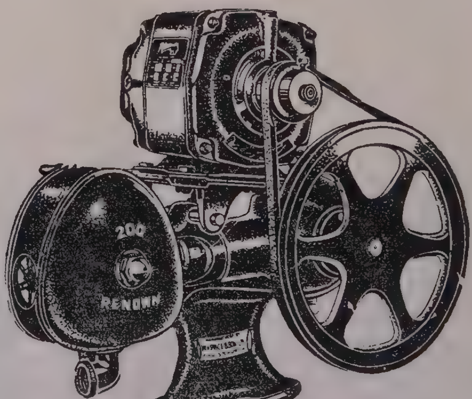

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is insufficient; for red clover, in the same conditions of potash supply, no responses, or only very slight ones, were secured. In this country considerable interest is being taken in the use of sodium chloride for pasture topdressing. Potash fertilisers are expensive and have to be imported. Substantial economies in the use of potash might be secured through the use of salt.

In recent years some 15 trials have been laid down on potash-responsive soils to compare salt and muriate of potash, alone and in combination, at rates of ½cwt. and 1cwt. per acre. Some of these trials have given promising results which will be checked with some pasture measurement trials and a further series of observational trials.

On Horotiu sandy loam and Waihou sandy loam slight growth responses were secured from salt alone but no effect from salt was seen on those plots where potash had been applied. In two trials on soils derived from Waihi ash and one on Awakeri gravelly sand (Kaharoa ash) salt alone at 1cwt. per acre was almost as good as muriate of potash at 1cwt. per acre and salt plus potash was definitely better than potash alone. For both materials the effect was seen in improved clover growth (mainly white clover), fewer weeds, and uniform, close grazing. Two trials on potash-responsive soils derived from basalt showed very little effect from salt. The herbage from one of the trials on Waihi ash soil (Katikati sandy loam) showed on analysis an increase in potash uptake due to the salt application.

These results are quite promising. A new series of trials will include "30 per cent. potash salts" treatments. These salts, as mined in Germany and France, contain substantial amounts of sodium chloride. They may prove, on an equivalent potash basis, to give better results than the relatively pure muriate of potash.

Manganese

Manganese deficiency symptoms in crops such as oats are stated to occur usually in soils of high pH value and in the presence of considerable amounts of organic matter (1). Such soils are not common in New Zealand, so it is not surprising that there is little or no evidence of deficiency of manganese. Nevertheless there is reason to believe that manganese toxicity may be important on some soils and that one of the effects of liming might be a correction of this toxic effect. There is clear evidence of many cases of marked reduction in the manganese content of herbage after liming.

No response to manganese salts has been secured in the 6 trials so far conducted. One of these trials was on the lime-rich Oamaru clay loam and two on the "tarry" soils of North Otago, the Waiareka complex. It would probably be worth while including manganese on some of the heavily limed soils of Otago and Southland where lime-induced manganese and boron deficiency might be likely to occur.

Iron

Apart from the use of iron compounds, including limonite, in the early bush sickness investigations (2) little work has been done with iron salts applied to pasture. Limonite is still sold as a topdressing material, particularly in the Waikato, and it is included in quite a few "special mixtures", but the Extension Division has never been able to demonstrate any effect on pasture growth from its use.

Iron deficiency chlorosis is usually found in soils rich in lime or manganese, which appears to immobilise the iron (1). As far as the writer is aware this deficiency disease has not been demonstrated on pastures in New Zealand; it is more likely to occur as a result of excessive liming in orchards and market gardens.

Zinc

In Florida zinc deficiency occurs in soils, particularly in citrus-growing areas, with a soil reaction above pH 6.0 and on acid sandy soils with pH 4.5 to 5.2 (21). Camp (22) remarks that the acid sands of Central Florida where zinc deficiency occurs have a low percentage of organic matter which constitutes practically all the colloidal fraction. On these soils zinc availability may be reduced through combination of the zinc with organic compounds. In Western Australia oats have responded to zinc on sandy soils with pH 5.5 to 6.0 (23).

The only known case of a zinc response on pasture in New Zealand has occurred on practically raw sand near Waiuku. This was not an official experiment and it would seem worth while to investigate the acid sands of New Zealand for responses to zinc on pastures.

Vanadium

The possibility that vanadium is an essential nutrient has received support with the recent work of Arnon and Wessel (24) with green algae. In New Zealand interest in vanadium arose from a study of the elements present in basic slag. A series of trials was laid down to endeavour to find why basic slag gives results better than superphosphate on certain soils.

At present there are only 4 trials which have been in progress for sufficient time on which to base opinions, and on one of these trials, at Kaitaia, a definite response of pasture to vanadium has been seen. This trial is on Mangonui clay, a brown granular loam derived from andesitic basalt. At Invermay on Warepa-like silt loam there was a possible visible response to ammonium vanadate, 1lb. per acre, which was confirmed in mowing weights, but the trial is not replicated.

A third trial in the far north on Te Kopuru sand has not been managed satisfactorily, and a fourth at Outram, near Dunedin, shows, if anything, a depression to vanadium. The Outram trial has been in progress for about 3 years, whereas the others have been down for only 1 or 2 years.

It is intended to expand work with vanadium, particularly in the Kaitaia district, as rapidly as possible. At the present stage of the investigations it would be unwise to predict the importance of these results or indeed to conclude that vanadium responses on pasture are likely to occur in any area or on any soil type.

Nickel

Roach and Barclay (25) report nickel responses on a range of agricultural crops at East Malling Research Station, but there appear to be very few cases of plant responses from nickel applications. It is suspected that nickel may be in some way associated with cobalt in the control of bush sickness (3). A significant pasture response to the application of 10lb. per acre of nickel carbonate at Waimumu, near Gore, is therefore of considerable interest. This trial, which was suggested by Davies of the Rukuhia Soil Research Station, is on Waimumu soils, which are classified under yellow-grey earths, wet coastal downs.

An earlier observational trial had given evidence of slight nickel responses and a pasture mowing trial was laid down to confirm these indications. Highly significant nickel, lime, and molybdenum responses were secured on the mowing trial from a cut on 13 January 1954.

Tungsten

A mowing trial at Outram has given clear indications of a response to sodium tungstate applied at 1lb. per acre. This trial included two rates of molybdenum and one of vanadium, with basic slag and superphosphate. On 3 September 1953, at the suggestion of Davies, one of the replications was dressed with tungsten. Observations and mowing cuts since this application have shown marked improvement on the tungsten plots on the superphosphate and superphosphate + vanadium treatments, but no improvement in the presence of molybdenum or basic slag. The molybdenum response is significant. Molybdenum : tungsten interaction investigations should repay close study on this soil type.

Future Work

With so many lines of investigation that require urgent attention it is difficult to allocate the limited staff and facilities available to best advantage. Molybdenum investigations are receiving first priority, but work with sulphur on pastures and lucerne is considered highly important. A survey of pasture responses on the major soil types of New Zealand will be made by observational trials which include molybdenum, sulphur, manganese, boron, copper, magnesium, zinc, and vanadium.

A series of 3 complex factorial trials under mowing are in progress at the Marton Experimental Area, Winchmore Irrigation Research Station, Ashburton, and the Invermay Research Station, Mosgiel. These trials include, in addition to two levels of lime, phosphate, and potash, the minor elements molybdenum, boron, sulphur, and magnesium.

Some further mowing trials will be planned to investigate vanadium responses in Northland, nickel responses in Southland, and molybdenum : tungsten interactions at Outram. A series of trials with sodium chloride on pastures and crops is planned for a range of potash-responsive soils. In all this is an

26—TRACE ELEMENTS . . .

ambitious programme, but on the results summarised in this article, it will be clear that such a concentration of work is likely to prove well worth while.

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Lamb Losses in Snowstorms

A SEVERE snowstorm while lambing is in full swing can cause heavy losses. These losses vary considerably and are influenced by many factors, such as the amount of feed and shelter available, and the attention it is possible to give the ewe flock over a stormy period. In this article C. A. Martin, Livestock Instructor, Department of Agriculture, Tapanui, describes the efforts of some West Otago farmers to reduce lambing losses.

During a 3-day storm baled hay was used to good effect on farms lacking good natural shelter. Miniature shelter belts of up to 12 bales laid out in a row were provided all over the lambing paddocks, with loose hay spread out on the lee sides to avoid puddling. As ewes lambed they sought, or were "eased into", this shelter. The bales were one high and provided shelter not more than 18in. high, but this was enough.

Bales laid on the side, two or more bales high, can be dangerous when blown over or knocked over by a ewe on to sheltering lambs and ewes. Bales can be used more than one high, and on end, against a wire fence on the weather end of an exposed paddock. They should be on the opposite side of the fence to where the lambs are sheltering. Sacks or covers can also be used along wire fences, but for cleanliness it is important to spread hay on the lee side.

During a lambing time storm, baled hay may be carried round in a truck. An unsheltered ewe and lamb may then be protected by having four bales placed round them in a square. Such hay may also be eaten by ewes when pasture is under snow, and the balance may be salvaged after the storm. Many farmers have huge stacks of hay left when winter feeding ends, and this or baled straw may be used to minimise lambing losses.

Book Review

"Developing a Profitable Dairy Herd": Merton Moore and E. M. Gildow

THERE is no more famous herd of Friesian cattle on earth than that of the Carnation Farms of the United States of America. "Developing a Profitable Dairy Herd", by the dairy man and veterinarian who have controlled the herd for many years and played a leading part in its development to its present high standard, purports to "lay bare the secrets of Carnation's success".

Though it is a book which will be of very real interest to Friesian fans in New Zealand, I feel that they as well as other students of cattle breeding will be sadly disappointed at the paucity of the so-called "secrets" on the breeding side. On the other hand, the book will receive much praise from those who believe that "90 per cent. of the breeding goes down the throat".

It is quite obvious that the authors attribute Carnation's undoubted success in building the highest milk-producing herd in the world to the application of special feeding and management methods to cattle bred along orthodox lines. In particular, the overriding importance of herd health is emphasised and much sound advice given.

The book is written primarily for American consumption, so that from a practical viewpoint the detailed methods described have little to offer New Zealand. As an interesting and stimulating addition to the dairy man's bookshelf it can be recommended. It is worth while if only for the last chapter, "Red Umbrella Selling", which describes the application of well-tried principles of selling to the disposal of pedigree bulls. Some, of course, might wish to ban the book on the grounds that New Zealand selling methods are sufficiently decorative at present without further complication by the glamour of American salesmanship.

—*C. P. McM.*

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Enterotoxaemia or Pulpy Kidney of Sheep and Lambs

ENTEROTOXAEMIA, known as pulpy kidney disease of lambs in New Zealand, is an acutely fatal bacterial disease. It has been responsible for great economic losses since it was first recorded as a disease of young lambs in the early days of veterinary investigation in New Zealand. In time it was found to cause deaths in grown sheep of all ages. It also affects goats, in which mortalities may occur under similar circumstances to those in sheep. This article by M. C. Armstrong, Veterinarian, Department of Agriculture, Timaru, describes the incidence, predisposing causes, symptoms, and post-mortem signs of the disease and the procedure for accurate diagnosis and sets out the methods of control by vaccination and management.

FOR many years the disease was thought to be a dietetic one due to overfeeding, lack of exercise, or the formation of milk curds and wool balls in the lamb's stomach. Eventually veterinary investigation in Australia and New Zealand confirmed the presence in the small intestines of affected lambs of a highly poisonous toxin which, injected into healthy lambs, could reproduce the disease.

Class of Sheep Affected

The disease is world-wide and may affect sheep of all ages, breeds, and sexes and at all times of the year. Losses may vary from ½ to 15 or more per cent. from farm to farm and from year to year. Largest mortalities in New Zealand usually occur in spring in lambs between 3 and 10 weeks old. Good forward single lambs and sheep in good condition are susceptible, whereas the disease is uncommon in twin lambs and sheep in hard condition. Losses commonly occur in lambs fattening on crops after weaning and in hoggets wintering on supplementary feeds.

Cause

The causal organism was isolated and named *Clostridium perfringens* Type D (previously referred to as *Clostridium welchi* Type D). The bacteria form resistant spores capable of survival for very many years and are commonly found in soil, animal droppings, and contaminating dust from soil and manure.

The disease is called enterotoxaemia because it is caused by the absorption from the sheep's intestine of epsilon toxin, a powerful poison which is produced by the very rapid growth of *Clostridium perfringens* Type D bacteria in the intestine.

The precise factors which determine the sudden and rapid growth of this organism in the intestine are not fully understood.

Predisposing Factors

The most important predisposing factor is a sluggishness of intestinal peristalsis or bowel stasis created by digestive disturbances due to diet, lack of exercise, or occasionally to run down conditions associated with poor nutrition or other diseases.

[*Campbell*

If left to rot, this carcass will infect the ground for many years.

During the early stages of research work into enterotoxaemia in Australia it appeared significant that artificial reproduction of the disease by injection of the toxin into healthy lambs was most successful after the giving of drugs which induced sluggish bowel movements.

Evidence in the field indicates that intensive methods of grassland management and the forcing systems adopted for fattening lambs tend to favour the onset of the disease.

Two main factors which influence the annual variation of the disease are first, the degree of soil cultivation or pasture improvement and second, the development of an apparent flock immunity resulting from continuous exposure to the bacteria. In this respect it is noticed that the mortality rate is greatest on properties recently affected whereas on properties affected for some time the mortality rate recedes below 1 per cent. in sheep bred on the place.

Predisposing factors or conditions associated with outbreaks of the disease are as follows:—

1. It most frequently occurs when there is an abundance of greenfeed and is common on lush feed containing little fibre.

2. In young lambs the incidence is highest between the ages of 3 to 10 weeks, during which the lamb is changing over to a diet of milk and grass. Good forward single lambs are most susceptible and the incidence is greatest in seasons when the spring flush of grass is early and the lamb has access to an abundance of milk and lush grass. Over-eating and digestive sluggishness are more likely in these circumstances.

3. After lambs have been weaned the disease is common in those feeding on rich, fattening crops such as rape. Many outbreaks are believed to result from the very sudden changes made from an all-grass to all-rape diet. Losses are also common in lambs which have been fattening well on rape for several weeks and are almost ready for drafting.

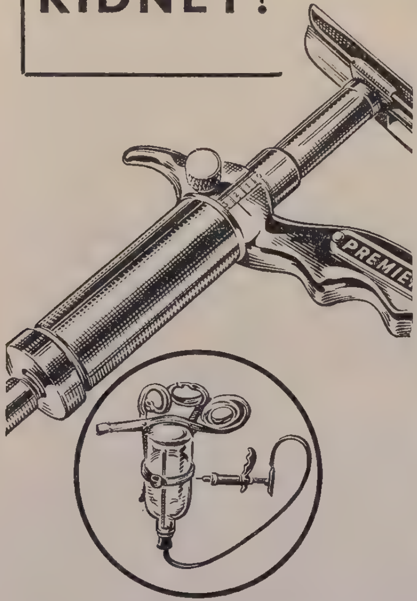
4. In many districts the disease is common in hoggets wintering on turnip crops, swedes, and chou moellier or other forage crops. Under these circumstances the ingestion of abnormal quantities of soil contaminated by spores of *Clostridium perfringens* Type D is a factor considered important by some investigators.

5. There are many outbreaks of enterotoxaemia in sheep in poor or run-down condition and in Australia particularly there have been heavy mortalities in ewes in poor condition during droughts. There is also evidence that other diseases, especially internal parasites and some plant poisons, may predispose the sheep to a rapid proliferation and toxin production by *Clostridium perfringens* Type D in the intestines.

Despite the conditions outlined above, outbreaks of enterotoxaemia in sheep do occur where no correlation with feed conditions can be established, and therefore the exact role of diet is not fully understood.

Symptoms

In the majority of mortalities from enterotoxaemia in both sheep and lambs deaths have occurred so rapidly and unexpectedly that no symptoms



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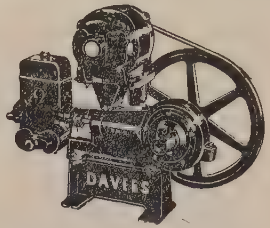

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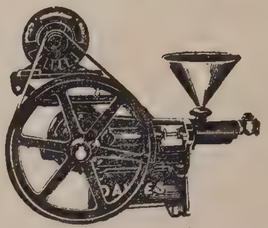

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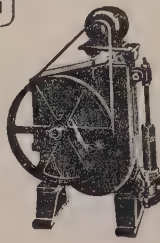

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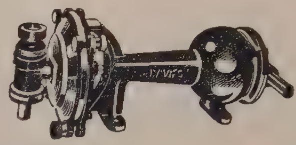

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[*Sparrow*

Where pulpy kidney infection is present such lambs as these, if there is a sudden increase or enrichment of their feed, are very liable to infection.

have been observed. Symptoms, however, have been recorded in both lambs and older sheep kept under close observation and these are of two distinct types, namely **convulsive** symptoms ending in violent death and **comatose** symptoms ending in quiet death.

Convulsive symptoms are more common in lambs and young sheep. The affected animals suddenly exhibit a fit of convulsions, rolling of the eyes, bleating, frothing at the mouth, and rapid death after a convulsive spasm.

Comatose symptoms are more common in adult sheep, which may exhibit staggering gait, blindness, weakness, wandering in circles, dullness, and quiet death within a few hours. Some degree of scouring is frequently observed. Non-fatal cases or recoveries do occur, and such sheep may show depraved appetite, depression, scouring, and then recovery.

It is emphasised that there is nothing very diagnostic about the symptoms, as similar symptoms may occur in diseases such as milk fever, blackleg, pregnancy toxaemia, and poisoning.

Post-mortem Appearances

If a post-mortem is done immediately after death, the characteristic pulpy changes in the kidneys of lambs may not be observed and an incorrect assumption may be made on kidney appearances alone. The most constant findings at and after death are confined to the heart and the nature of the fluid which surrounds it within the heart sac. Small hemorrhages and blood splashes will be seen just under the clear membrane which lines the outer and inner muscle walls of the heart. In place of a small quantity of clear, oily fluid in the heart sac there will be an excessive amount of blood-stained fluid which may be partly or wholly gelatinous. Opening of the brisket along one side of the midline will expose the enlarged heart sac containing the heart surrounded by the excessive quantity of abnormal fluid described.

The characteristic changes in the kidneys are most apparent 2 hours or more after death. At this time an incision through the capsule reveals the kidney, which may be mushy or pulpy to varying degrees and may range in colour from dark red to pink or grey. Occasionally the kidneys are firm in texture and covered with dark red blotches of congestion.

The carcass is usually but not always in good condition and rapid decomposition or putrefaction after death is characteristic. Within a few hours of death the carcass is distended with gas, the wool is easily plucked, there is froth at the nostrils, and the skin is often dark bluish in appearance, rather similar to many cases of blackleg or blood poisoning. When the abdomen is opened the paunch and intestines are generally distended with gas and the liver appears congested.

Enterotoxaemia has sometimes been confused with tetanus, which often causes deaths in lambs within 3 weeks of their being marked. In tetanus, however, there are characteristic convulsive spasms of the body and rapid, short breathing for several hours before death and the limbs are rigidly extended both before and after death. Blackleg and other types of blood poisoning can frequently be distinguished by a swelling of the body muscles or an area of swollen muscle which contains dark red, gassy fluid.

The only certain method of diagnosis in cases of doubt is by the submission of specimens to a veterinary laboratory.

Diagnosis

Diagnosis is an important prerequisite before the adoption of control measures. Accurate laboratory diagnosis of enterotoxaemia in sheep of all ages is based on the detection of lethal quantities of *Clostridium perfringens* Type D toxin in the intestine of recently dead sheep. The investigator collects the contents of the posterior portion of the small intestine and adds a few drops of chloroform as a preservative. At the laboratory the contents are centrifuged and filtered. Very small quantities of the fluid so prepared are injected into mice, which are examined after 24 to 48 hours. Another series of mice receive the suspected fluid plus an equal quantity of neutralising antitoxin. These are the controls. A positive diagnosis is indicated by the death of the mice that did not receive the neutralising antitoxin.

Farmers who desire an investigation into losses in sheep should enlist the specialist services of Veterinary Surgeons or Livestock Instructors.

Prevention and Control

Mainly because symptoms are seldom seen and deaths are usually sudden, an effective treatment is not available, and prevention is therefore of great importance.

Prevention by Management

Before the advent of successful vaccination prevention was aimed at reducing the possibility of digestive disturbances and giving the lambs or the sheep a check, with the result that many outbreaks could be reduced by management alone. Complete control by vaccination is not always opportune or possible and control by management should not be overlooked. The various management practices adopted depend on the conditions under which the disease appears.

Some recommendations are as follows:—

1. As losses in young lambs 4 to 8 weeks old have been reduced by marking them younger than usual, this practice should be adopted.
2. Uniform feeding of the lactating ewes under a set stocking system will help to avoid upsets in lambs possibly due to fluctuations in the ewes' milk supply.
3. All changes to richer feeds or contrasting feeds such as pasture to crops, especially with older lambs after weaning, should be spread over a few days by gradually increasing the time on the new feed each day where possible.
4. The ewes with twins should be drafted off after lambing and given the better feed. The ewes with singles can be fed fairly hard for 3 weeks after lambing, as they have more milk than the lambs should consume.
5. Where losses in older sheep occur on rich clover, young grass, or lucerne pastures it is advisable to try a hay or chaff supplement or use of a poor grass paddock at night until immunity by vaccination can be established.
6. Sheep flocks bred and continually depastured on properties where the disease has been prevalent for some years tend to acquire a natural immunity and for this reason a policy of farmers' breeding their own lambs and replacements on pulpy kidney areas would minimise the incidence of the disease.

Prevention by Vaccination

With efficient enterotoxaemia vaccines now available commercially control of the disease by immunisation where it is troublesome is a positive method of considerable economic importance. Two distinct types of immunising preparations are available, namely enterotoxaemia vaccine and enterotoxaemia antiserum. The correct dosage will be found on the instructions issued with each container of vaccine.

Enterotoxaemia Vaccine

Enterotoxaemia vaccine is an alum-precipitated toxoid vaccine prepared from cultures of *Clostridium perfringens* Type D, and recommendations for its use are as follows:—

1. **To protect lambs 2 to 8 weeks of age** the ewes should be vaccinated before lambing. If the ewes have not been done before, a standard or sensitising dose should be given at or shortly after mating and then a larger booster dose given 10 to 14 days before lambing begins. The interval between these two injections should be at least 6 weeks, which ensures the maximum transference of immunity to the lamb from its mother via the colostrum or first milk. In successive pregnancies the booster dose mentioned above administered shortly before lambing

Vaccination equipment. The syringes are in the foreground and at the left is the boiling equipment for the sterilisation of syringes and needles.

should suffice. Ewes should be divided into early and late lambers and each lot vaccinated 10 to 14 days before lambing begins.

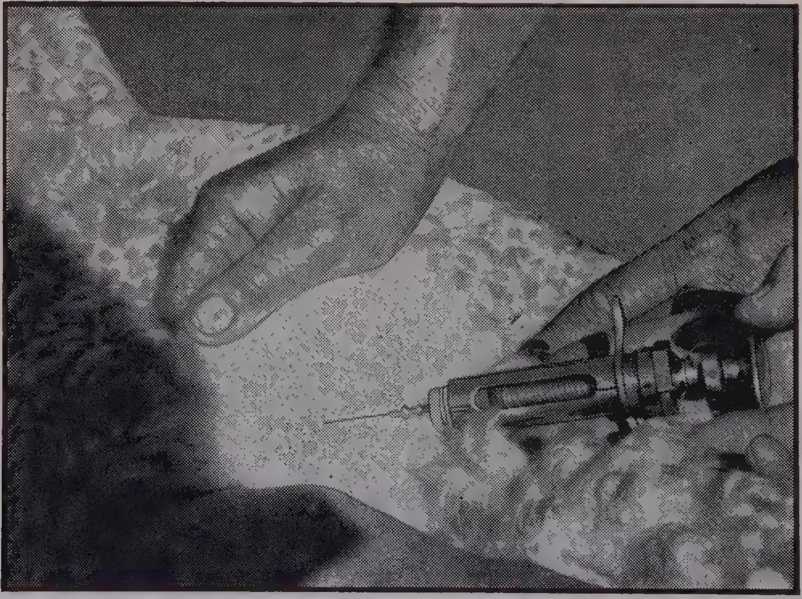
It must be emphasised that vaccination of ewes will not protect their lambs after about 8 weeks of age.

2. **To protect lambs 6 to 12 weeks of age and fattening lambs** the lambs should be vaccinated at marking time or a fortnight before the disease usually appears. A standard dose of vaccine should be injected just under the loose skin on the inner side of the foreleg between the knee and the elbow. The lambs may show lameness of the foreleg for several days after the injection, but this is not serious.

Alum-precipitated vaccines cause a swelling at the site of injection and even after 3 to 4 months a small nodule will be present in most of the vaccinated lambs. Injection on the inner side of the forelimb will avoid the rejection of lambs sent to freezing works.

3. **To protect hoggets on forage crops and adult sheep** a standard dose of vaccine should be injected just under the skin behind the shoulder while the animals are standing in a race, preferably of a temporary nature, erected on clean pasture if good concrete yards are not available. Care must be taken not to inject into muscle tissues.

A single injection of a standard dose of vaccine into lambs at least 4 weeks old and older sheep is an efficient protection against moderate infections for at least 12 weeks. Where the disease is severe in incidence a second injection of the same amount a month later is recommended to ensure adequate protection. As it takes 10 to 14 days for immunity to develop after injection, deaths may still occur during that negative period.



Vaccination behind the shoulder with a 20 c.c. syringe. The wool has been parted and the skin lifted slightly and the needle is ready to be inserted subcutaneously with a light thrust.

Enterotoxaemia Antiserum or Pulpy Kidney Antitoxin

Enterotoxaemia antiserum or pulpy kidney antitoxin should be used only on the recommendation of a veterinary surgeon. It is an antitoxic serum which confers an immediate high level of passive immunity that remains effective for about 3 weeks.

The dose for lambs is smaller than that for older sheep and is given by injection under the skin at the same sites as recommended for the vaccine. The antiserum is useful for valuable animals and is usually given simultaneously with the vaccine to obtain an immediate immunity when an outbreak occurs.

Vaccination Precautions

The following precautions are necessary to prevent losses after inoculation of sheep with enterotoxaemia vaccines and other vaccines.

The instructions issued with the vaccine should be read carefully, the bottle seal checked for soundness, and the date on the label examined to ensure that the vaccine has not passed the expiry date.

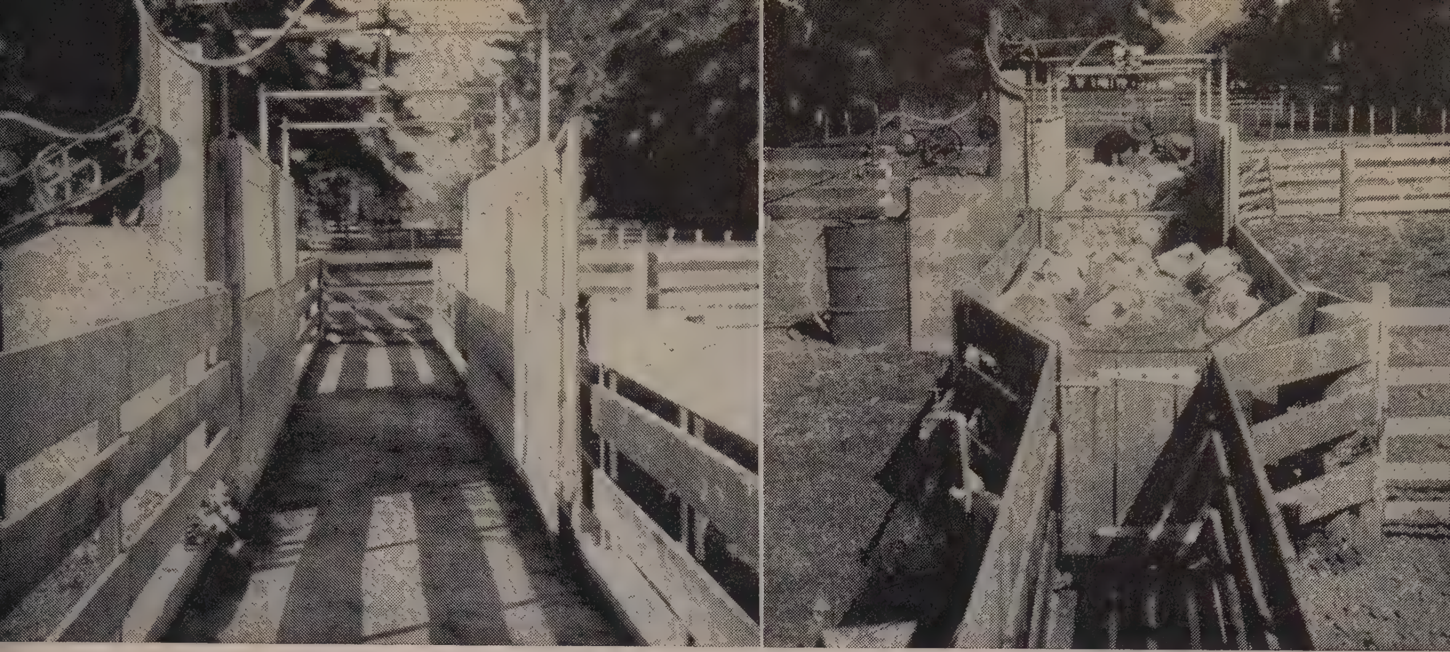
Sheep should be vaccinated in temporary yards on spelled pasture. Syringes and equipment should be sterilised by boiling them for 10 minutes in water. The pistons must be removed from glass syringes before the syringes and pistons are boiled. Spare needles should be soaked in methylated spirit and the needle changed frequently. The vaccine is protected from dust contamination by direct withdrawal from the bottle to the syringe via a rubber needle piercing stopper, by use of an automatic syringe, or by the vaccine being kept in sterilised covered containers.

The recommended method of vaccinating older sheep behind the shoulder while they are standing in a race is to expose the skin site by parting the wool, raise the skin slightly, and thrust the needle on a slant just through the skin. A deep stab with the needle must be avoided to prevent losses caused by the activation of latent disease spores in damaged muscle, that is, the vaccination must be subcutaneous (just under the skin) and not intramuscular (into the flesh).

Vaccination should be delayed if possible when the skin is wet with running moisture, and dirty or muddy conditions should be avoided.

Prompt Disposal of All Carcasses

One of the simplest ways to spread infectious diseases over farm lands is to leave carcasses lying about for hawks, seagulls, and other predatory birds and animals to scatter infected debris. As mentioned earlier the spores of *Clostridium* organisms can live in the soil for very many years, and to cut down these diseases more attention is necessary to see that dead animals are promptly burnt or buried to a depth of at least 3ft.



HEADING PHOTOGRAPH: Home-made jetting equipment, by which insecticide is applied under pressure to the sheeps' wool to control fly strike. Photographs by courtesy of Mr. P. P. L. Dillon, "Leefield", Marlborough.

Control of Blowfly Strike in Sheep

FARMERS are beginning to realise that research work done with the newer insecticides, particularly D.D.T. and gamma benzene hexachloride, has made it possible to evolve practical methods for both the prevention and treatment of blowfly strike in sheep. This work and its practical application are dealt with in this article by W. S. Allan.

STRIKE is the result of maggots feeding and burrowing first into the skin and then into the flesh of the sheep. The exudate and the odour from the struck area attract more blowflies, the eggs of which rapidly hatch to produce more maggots, which, if left unchecked, will quickly kill the sheep.

Flies Responsible

Calliphora laemica (one of the common brown flies) and *Lucillia sericata* (a small bronzy-green fly) are the two flies responsible for primary strike in sheep. Both produce smooth maggots and are the only New Zealand types which will initiate a strike. The only other important fly is secondary and strikes only at the site of attack by primary flies. This is *Chrysomyia rufifacies*, the bluey-green fly with each segment of the abdomen edged with a black band. The maggots are hairy. Bluebottles do not strike sheep.

The female fly lays her eggs in batches of approximately 100 and may lay a total of 1000 during her life. Within a few hours the eggs hatch and young larvae begin to feed. They moult twice (each moult may mature in 24 to 48 hours) and reach their maximum size in from 5 days to 3 weeks. The adult fly lives about a month.

The vital part of this life history as far as strike is concerned is the active larva or maggot. Obviously without it there would be no strike.

Possible lines of attack are therefore:—

1. To prevent the adult fly depositing eggs.
2. To ensure that the eggs, if deposited, do not hatch into maggots.
3. To kill off the maggots at an early stage or before they have killed the sheep.

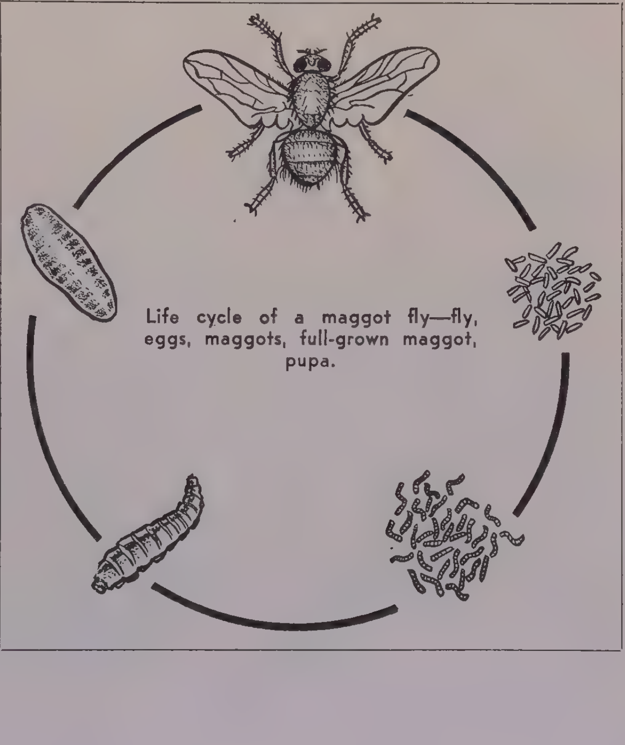
The part the farmers can play in assisting toward this attack and the part played by the modern insecticides which are now available are outlined below.

Practical Control Methods

Practical steps the farmer can take to ensure that this active maggot stage is never reached comprise, first, non-insecticidal control measures. These are important. The first is crutching, and the second is control of tail length.

Non-insecticidal Control Measures

Blowfly eggs will not develop into active maggots on a dry skin. Crutching dries the skin, and crutching alone will provide 2 to 3 weeks' protection against strike. Control of tail length is more important than many farmers realise. Most tails are cut too short. A tail of ideal length is one the stub of which after healing should exactly coincide with the tip of the vulva, and thus provide the necessary protection for the vulva and prevent distortion of it and the consequent staining of the crutch wool by a misdirected stream of urine. Further, the healing period is longer in lambs whose tails have been cut short, and short-tailed lambs show a much higher percentage of strikes in docking wounds than lambs with longer tails.



Life cycle of a maggot fly—fly, eggs, maggots, full-grown maggot, pupa.

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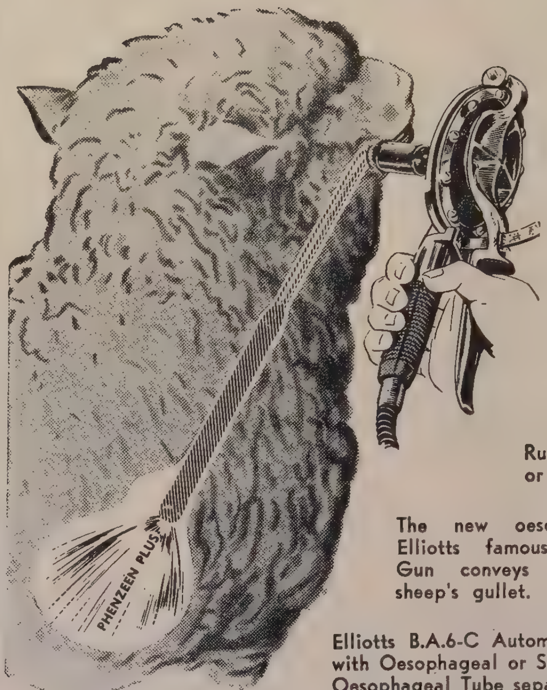

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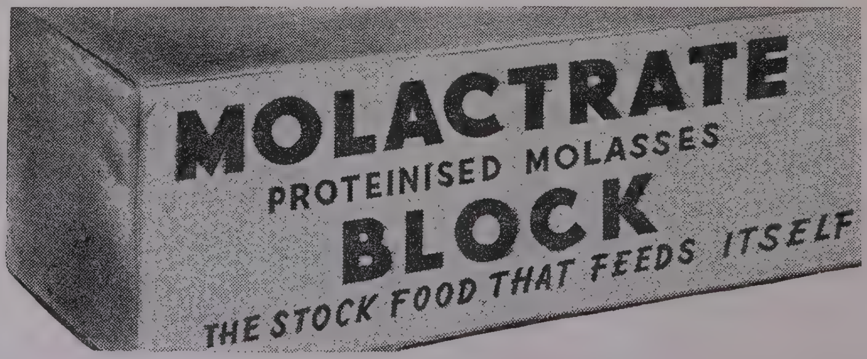


Careful attention to such factors as adequate crutching, suitable control of tail length, and prevention of scouring by control of internal parasites will materially assist in reducing the incidence of sheep blowfly strike. If the farmer still gets strike, he should seriously consider the advantage of preventive insecticidal control measures.

Insecticidal Control

Intensive researches in many countries covering trial work in both field and laboratory have been carried out continuously by teams of scientific workers for the past 10 years. This work has proved that of all the insecticides available, until quite recently, D.D.T. and B.H.C. represent the most valuable maggot fly control agents available. The work has covered length of protection, mode of action, formulation, and optimum concentration of these insecticides, either singly or in combination.

Some of the proprietary remedies which are now available to farmers in New Zealand are the direct result of these researches. Claims are made for 5 weeks' freedom from strike in the field after hand spraying or jetting, and 10 weeks after dipping. These claims are not based on guesswork. With the well-known and accepted brands the claims are based on large-scale user trials involving the use of hundreds of thousands of sheep, and what is more important still, on rigidly controlled trials carried out not under field conditions, but under insectary conditions.

These conditions are much more severe than would ever prevail in the field. Sheep are enclosed in insectaries capable of holding about 30 sheep at a time. Both temperature and lighting are controlled. Thousands of sheep blowflies are liberated into the insectary. At least 2000 fresh flies are added each time a fresh batch of sheep is exposed. To simulate natural conditions the sheep are made as attractive to the flies as possible. An extract of macerated maggoty liver is used as an attractant to the flies. The sheep are then lightly sprayed with tap water in an attempt further to attract the flies by producing a wet sheep odour and a moist condition for egg laying. Within the chamber water and dry sticks of sugar are available as a maintenance ration for the flies. It is apparent therefore that any claims based on these conditions are conservative when applied to field conditions.

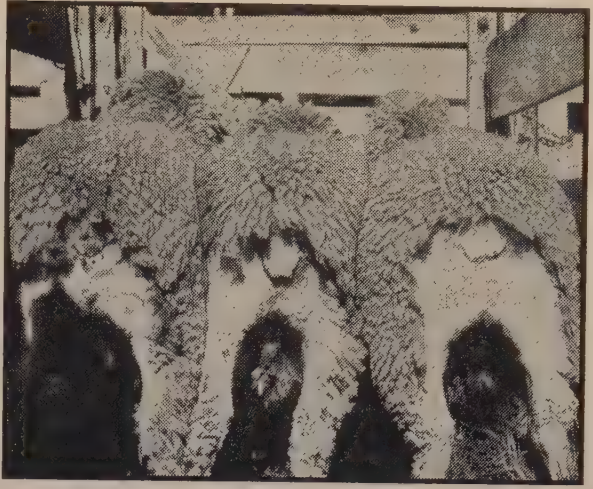
Action of Insecticide

Strike is the direct result of the maggot or larva eating into the skin surface. If by application of the chosen insecticide to the sheep the adult fly can be prevented from depositing eggs on or near the skin surface, or the egg can be prevented from hatching into a larva or maggot, two very vulnerable stages in its life cycle would be attacked. Success in either case would mean that the larva or maggot stage would never be reached and of course without the maggot there could be no strike.

Unfortunately D.D.T. at the concentrations used does not kill the eggs nor does it exert much action on the maggots. It is essentially anti-adult in action. Its action depends on its sub-lethal intoxication of the fly and seems to hinge on inhibiting the laying of eggs by the female fly.

Contrary to general opinion, the female fly does not lay rapidly. Usually the fly alights in the vicinity of a urine or faeces stain. She then spends some minutes probing for a suitable site. Having selected a suitable spot, she settles down within the wool fibres, probes down toward the skin, and deposits her full cluster of eggs.

During the experimental work it was found that if D.D.T. was present in the fleece, the fully charged female fly would spend almost as much time probing the prospective site for egg laying as she did on a clean sheep.



The 2-tooth sheep in the centre illustrates correct crutching and correct tail length. The tails of the sheep on either side are cut too short. The tail stub after healing should reach the tip of the vulva.

Gamma benzene hexachloride has proved to be definitely superior to D.D.T. as a larvicide and it will expel maggots from a wound. A combination of both D.D.T. and B.H.C. at approved concentrations provides both anti-adult and larvicidal properties. For preventive treatment, then, the insecticide of choice is D.D.T., but for control of actual maggots B.H.C. is preferred. As a result of the prolonged and detailed research work done with both D.D.T. and B.H.C. these materials have been formulated and are now available to farmers.

Application of Insecticides

Is it better to dip with these materials, or is it better to spray or jet? Dipping in these fly dip preparations is undoubtedly superior to spraying or jetting, but the cost is high and unfortunately the peak blowfly incidence rarely coincides with the immediate post-dipping period. Dipping is therefore not the complete answer.

There is no dip on the market which when used at ordinary dipping strength will at a single dipping give prolonged protection against blowfly attack over a significant period.

The arsenical sulphur derris powders used at ordinary dipping strength will protect sheep from strike for up to 3 weeks after dipping, but under severe blowfly conditions sheep may be struck within this period. B.H.C. dip at strengths recommended for ordinary dipping for keds and lice will, under the severe controlled experimental conditions already outlined, provide no post-dipping fly control and none is claimed for it. Under field conditions B.H.C. may provide 3 weeks' protection, but the action is predominately

A well-crutched ewe lamb. The crutcher is about to run round the whole crutch to trim off long ends. Adequate clearance has been allowed above the teats.

larvicidal (against maggots only) and the anti-adult action fails much earlier.

Control from Spraying or Jetting

Jetting is the application under pressure of insecticide to the wool. On a cost efficiency basis this is the real answer to the problem. The farmer should jet as an emergency measure at the onset of a fly wave, or better still, undertake systematic jetting each year immediately before the date on which experience has shown he may normally expect a fly strike. The number of times he requires to jet depends entirely on the duration of the fly attack. One jetting, provided it is done thoroughly, will protect the sheep for 5 or 6 weeks. Two jettings should therefore carry the farmer over the peak fly period.

The period of protection depends on the thoroughness of the application. For crutch strike complete saturation with a ringing of the tail is necessary. Since this jetting costs about 4d. per head, it is obviously less costly to jet twice than to dip once.

In the absence of a shower dip, the jetting can be done in a drafting race, preferably one with a concrete floor. Even with a concrete floor, this method is not particularly good, because the run-off is such that the ground becomes muddy and the sheep are liable to get very dirty. The best method is to use the grated floor of the holding section of the woolshed. Sheep can be jetted in convenient batches of about 25 and the grated floor eliminates any mud puddling, and the surplus run-off goes through the grating.

Correct spraying equipment is essential if the job is to be done satisfactorily. Knapsack sprayers or ordinary bucket pumps are quite satisfactory for treating individual sheep, but are hopeless for mass treatment. A pump with a release valve must be used. This pump can be hand operated if necessary, but high pressures and a correct fish-tail jet are essential.

Saturation of the treated area should be the aim, particularly for crutch strike. Good saturation is given by 70lb. to 80lb. per square inch. Lower pressure can be used, provided the jet is held close to the wool and the insecticide bubbled into the wool, but usually a low pressure means incomplete saturation.

For crutch strike not less than 1½ pints per head should be applied. For crutch and body strike the minimum requirement is 3 pints per head, according to wool growth.

If jetting is done in the pens of the woolshed, it is a distinct advantage to have sufficient hose between the pump and the hand-operated release jet to enable the operator to lead this hose from the pump over the rafters of the woolshed so that the hose drops on the centre of the jetting pen.

A 1 to 1½ h.p. motor with release valve pump is ideal equipment and of the hand-operated spray pumps, the portable type with a container holding 10 gallons is recommended. All that is required is an additional length of hose.

The recommended fish-tail jet is one not less than a No. 67 type.

When to Jet

The jetting of sheep before the date on which experience has shown fly strike can normally be expected has already been recommended. In theory this, of course, is sound; in practice, it brings with it some difficulties. With grown sheep it is not normal to get either body or crutch strike for 3 to 4 weeks after shearing, except of course on shear cut wounds. Further, crutch strike does not occur for 3 to 4 weeks after crutching. It would therefore be foolish to jet at this time. Not only would it be unnecessary, but there would be insufficient wool on the sheep to hold the insecticide and provide the necessary residual protection.

Jetting for crutch strike should be done after the protection afforded by crutching has elapsed and when the crutch has sufficient wool on it to hold the insecticide. In this respect it is a substitute for a second crutching. This means a second muster in fly susceptible areas, and the necessity for it has to be weighed against the loss and labour involved in coping with treatment of struck sheep. Normally, strike on hoggets or grown sheep is most troublesome when they are three-quarter to full woolled. It is then that the beneficial effects of jetting will be obtained. Jetting should not be done until a month after crutching. If dagging is necessary, this of course should be done, because no insecticide will cope with dags or prevent strike on a daggy crutch.

Fly Strike in Lambs

Fly strike in lambs must be treated as a separate problem. Farmers are sometimes troubled by strike on marking wounds, particularly on tail stubs. Over a wide area of the North Island strike occurs not necessarily immediately after docking, but at some period between docking and shearing of the lambs, from September until the end of the year.

Would the application of an approved insecticide to the tail or purse at marking time provide any protection to the tail stub during healing and if so, what is the best method of application at this time?

During the past three lamb-marking seasons the writer carried out trials in New Zealand designed to give a specific answer to these questions.

D.D.T.-B.H.C. preparations have been applied to the tail and the purse and the trials have covered both the knife method and the rubber ring method of castrating and tailing. For these trials, properties were selected where the normal incidence of strike after tailing was known to be bad.

With the D.D.T.-B.H.C. preparations applied at marking time no conclusions could be drawn because insufficient strike occurred in the control lambs and there was thus no measure of comparison between treated lambs and untreated control lambs. No real factual data are therefore available to support the application of D.D.T.-B.H.C. to the hindquarters of lambs at marking time.

New Insecticide Tested

During the past 2 years a completely new synthetic insecticide, Dieldrin, has been under test. Trials have been made in the United Kingdom, South Africa, Australia, and New Zealand.

This insecticide combines a high toxicity to maggots with an extraordinarily long period of protection and it is possible that a single application will protect sheep from body strike for a whole season.

The writer has conducted trials with this new material over a wide area in New Zealand during the past lambing season. The hindquarters of the lambs have been immersed at docking as outlined below. These trials have provided evidence that even in bad blowfly areas the protection afforded will be in terms of months instead of weeks.

In other words, treatment at docking will provide absolute protection against crutch strike until the lambs are shorn in December. This should cost the farmer about 2d. per head. Jetting trials also conducted by the writer during the past summer with this new material have confirmed the results obtained with the same material in England, Australia, and South Africa, and have shown that it is a great improvement on either D.D.T. or B.H.C.

In fact, instead of talking in terms of 5 weeks' protection by jetting with D.D.T. it is possible with this new material to talk in terms of 5 months' protection.

Treatment of Lambs at Marking

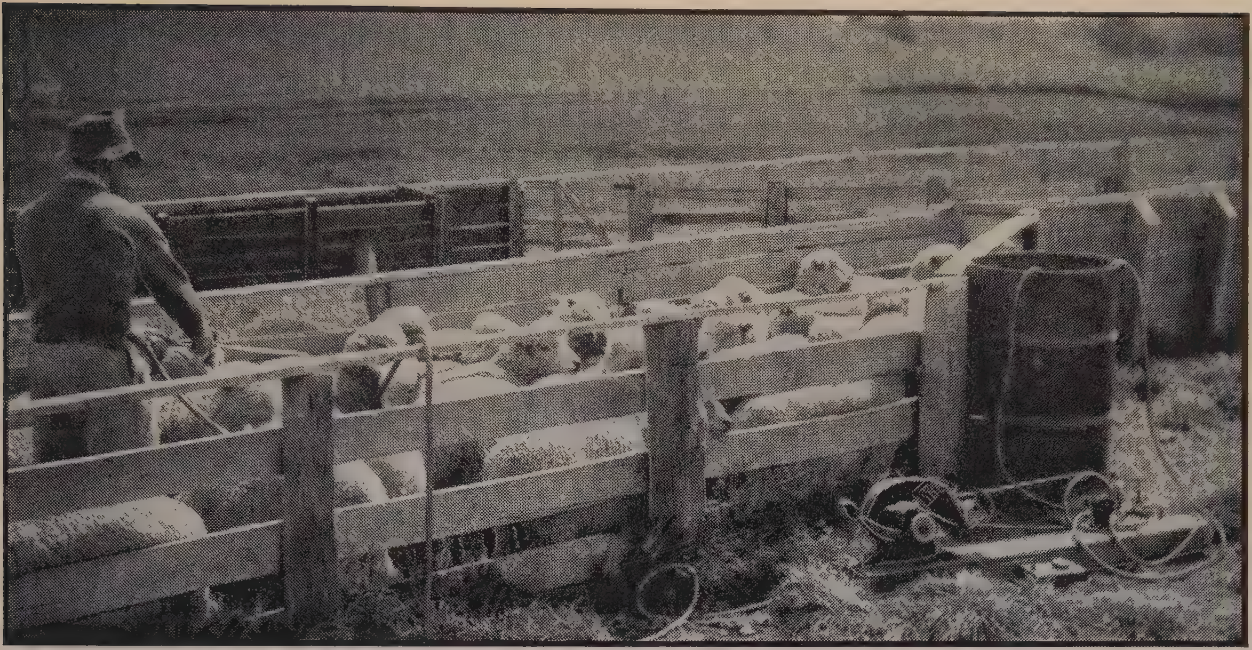
If treatment with the new insecticide is to be carried out at marking time, the following procedures, which have been found effective, can be recommended.

Trials under station docking conditions have shown that the application of insecticide to the hindquarters of lambs after earmarking, castrating, and tailing are completed and before release of each lamb present no real difficulties, whether the docking be done with a knife, a rubber ring, or an emasculator.

By trial and error it was discovered how best to apply the insecticide. Swabbing the tail and purse with a sponge from a 5-gallon drum of the insecticide was first tried. This method was not satisfactory because saturation of the tail stub was incomplete. Next, with a spray pump and an ordinary bucket pump, an attempt was made to spray the insecticide on the tail while the lamb was still held by the catcher. This resulted in the holder getting just about as much insecticide as the lamb.

If, however, the jet is held close to the lamb, this objection is reduced somewhat. With a power-operated spray pump a pressure of 70 to 80lb. is obtained and with suitable jets fitted to the release valve and the jets held close to the sheep there is surprisingly little run-off and surprisingly little wetting of the holder of the lamb. The tail is ringed with insecticide by the holder simply turning the lamb over before releasing it.

Trials conducted during the 1953-54 season indicated that even with a power-operated jetting system the results obtained were inferior to the results obtained when the hindquarters were completely immersed in the insecticide used. The final method tried, and that which was adopted, was to split a 44-gallon drum in halves lengthwise and partly sink this in the ground for stability and dip the tail and crutch in the insecticide after the castrating and tailing operations are



Power jetting equipment makes spraying for crutch or body strike easy.

completed and before release of the lamb. The immersing of the hind-quarters takes only 2 or 3 seconds. Where a rubber ring or an emasculator is used there is no pollution of the insecticide. Where a knife is used pollution by blood does not present real difficulties.

Farmers who prefer to use a knife can immerse the hind-end of the lamb after the operation is completed and before release of the lamb. Pollution of the insecticide can be reduced to a minimum by reducing the size of the container.

A 4-gallon oil drum or even a 44-gallon drum cut in halves crosswise could be used. Lambs immersed in this manner will use up roughly 1 pint per head, so that a 4-gallon oil drum would require refilling after about each 30 lambs had been done. This frequent refilling of the container is tedious, but this method sufficiently prevents pollution by blood even when a knife is used.

The procedure may sound complicated, but it is in practice quite simple to operate. If the container is raised to the level of the marking rail, the holder can do the immersing of the hind-end of the lamb before releasing it. It certainly means an extra man attending to the water supply and the refilling of the container used. Apart from an extra man, the only limiting factor is the availability and accessibility of water. Where all the equipment has to be packed out and where marking pens are constructed (as they frequently have to be) on the tops of ridges far removed from water, this may be impracticable. If, however, water is not a problem, this procedure will pay dividends on any property where the incidence of strike between docking and shearing is high.

Rubber Rings v. Knife

Is it better to use a knife for tailing than to use a rubber ring, and does the use of a rubber ring increase susceptibility to fly strike?

Some detailed comparisons covering the use of a knife and rubber ring for both tailing and castrating lambs revealed that the final results with the rubber ring were very satisfactory and not a single case of sepsis occurred.

Before final separation of the appendages circular wounds appear above the rubber rings and after separation an unhealed wound may exist for some 10 days. The time required for the detachment of the appendages and the healing of the subsequent wound was on an average 3 weeks for tails and 6 weeks for scrotums, as opposed to some 10 days when a knife is used.

Before the tail drops off there is an open ring of broken skin and often there is visible up to 1in. of dying and drying muscular tissue exposed to the air. Again, after the tail has dropped off a small unhealed wound remains and this generally requires a further 10 days to heal. These exposed areas and tail wounds have been struck under New Zealand conditions.

In castrating or docking with a knife, unless sepsis takes place, the wounds usually heal within 10 days as opposed to 35 to 40 days with a rubber ring.

There is no doubt that after use of a ring the unhealed wound is exposed to fly attack considerably longer than with the use of a knife. With use of a knife marking wounds do not become predisposed to strike until the scabs start to break down about 5 days after marking.

The writer would favour the knife, but has no experimental evidence that under trial conditions the use of the rubber ring increased susceptibility to fly strike.

Where tetanus is present on a farm the use of rubber rings should be avoided.

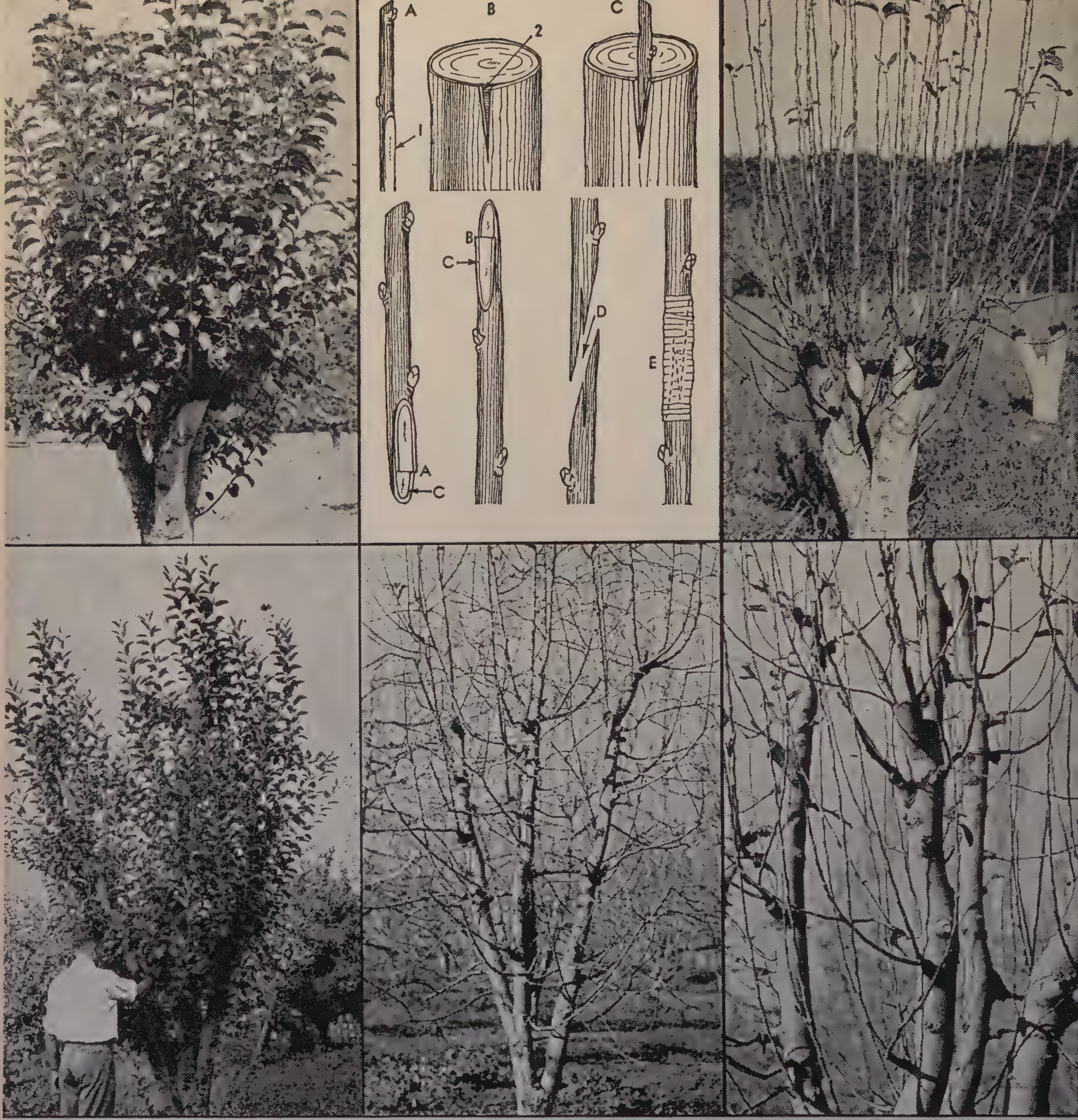
Treatment of Sheep already Struck

Frequently, farmers have to cope with sheep which are already struck. It is difficult to detect strike in its early stages. Nine times out of ten the strike is deep seated when it is first noted and attempts to dress these wounds usually fail. The adopted treatment is often effective as far as ridding the wound from maggots is concerned, but more often than not the sheep dies. The perfect fly dressing should kill or remove all maggots without injury to the sheep or wool, be non-irritant to the skin or wounds, dry up the struck area, and be soothing to the wounds. Finally, it should prevent egg laying on the wound to prevent restrike until the wound is healed.

Until recently there were no maggot dressings on the New Zealand market which satisfied these requirements fully. All the dressings used involved some compromise. Maggot dressings are now available which meet all the above requirements.

The two insecticides D.D.T. and B.H.C. already referred to are used in the formulations offered to farmers in New Zealand and used extensively in Australia, Great Britain, and South Africa. The newer insecticide, Dieldrin, has now been formulated and will be offered in limited quantities during this lambing season.

Intelligent use of these formulations can and will considerably reduce worries from sheep blowfly, particularly in areas where blowfly incidence is normally high.



Upper left and right—22-year-old Statesman apple tree cut hard back and grafted over to Golden Delicious in October 1952 (photographs taken in March and July 1953 respectively). Upper middle—Rind or bark graft (upper) and whip graft (lower) methods. In rind grafting sawn ends of stock limbs should be pared smooth first. The scion (A) is cut on a long slant and one edge (1) of the bark cut to make a close contact with the bark of the stock (B2) when the scion is inserted between bark and wood on stubs of cut-off limbs. The knife cut on the stock (B2) should be made vertically into and through the bark but not into the wood. If necessary the bark may be lifted to one side. The scion should be pushed down beneath the bark so that the cut portion fits closely against wood and bark at 2. The bark and scion should be tied tightly or a tack should be driven through them. The affected parts should be covered with a sealing compound when the scion is in position as in C. One or more of these grafts may be used on each stub. In the whip graft a flat, slanting cut is made at the basal end of the scion and a downward pointing tongue (A) is made in its upper half. A corresponding slanting cut is made on the stock and an upward pointing tongue (B) is made in its upper half. The tongues interlock (D) and the cambial regions (C) are in contact over as great a length as possible. Tying (E) and sealing of all exposed cut surfaces complete the operation. Lower left and right—26-year-old Statesman apple tree refurnished with Richard Delicious in October 1952 (photographs taken in March and July 1953 respectively). The right-hand illustration shows the number of scions and growth made in one season. Lower middle—Statesman tree grafted over to Golden Delicious in October 1950, showing the number of scions and the vigour of the growth made when the photograph was taken in July 1953.

Two Methods of Grafting over Apple Trees

By C. L. NAPIER, Horticultural Instructor,
Department of Agriculture, Hastings

THE grafting over of established apple trees is a task that is done in most districts almost every year. The main reasons for grafting over are to replace surplus trees of a particular variety or to change unprofitable varieties to more favoured ones. As grafting is normally done in spring, time is a factor that must be considered if all urgent spring-summer tasks are to be completed. Many growers may therefore adopt the quickest possible method of grafting over, though this may not always ultimately pay dividends. In this article the two most widely used methods with their advantages and disadvantages are discussed.

FRUIT growers often find that after a number of years some apple varieties become unpopular with the consumer. The number of trees of some varieties may also be difficult to handle, and growers have to consider replacing some with trees of other varieties. Providing the trees are healthy, grafting over is the quickest method of replacing the old varieties with more suitable ones and bringing them into production.

The time taken in the actual grafting operation and also the length of time it takes for the new variety to produce a full crop are the main factors affecting the choice of method of grafting over.

Advantages of Grafting over

The chief advantage in grafting over mature trees is that the new variety comes into production some years earlier than would trees planted at the time of grafting over. Cropping should not be lost for much more than 3 years and the first crops are much heavier than would be those of young trees. Grafting would probably cost no more for labour than would the alternative method of digging out and replanting with new trees.

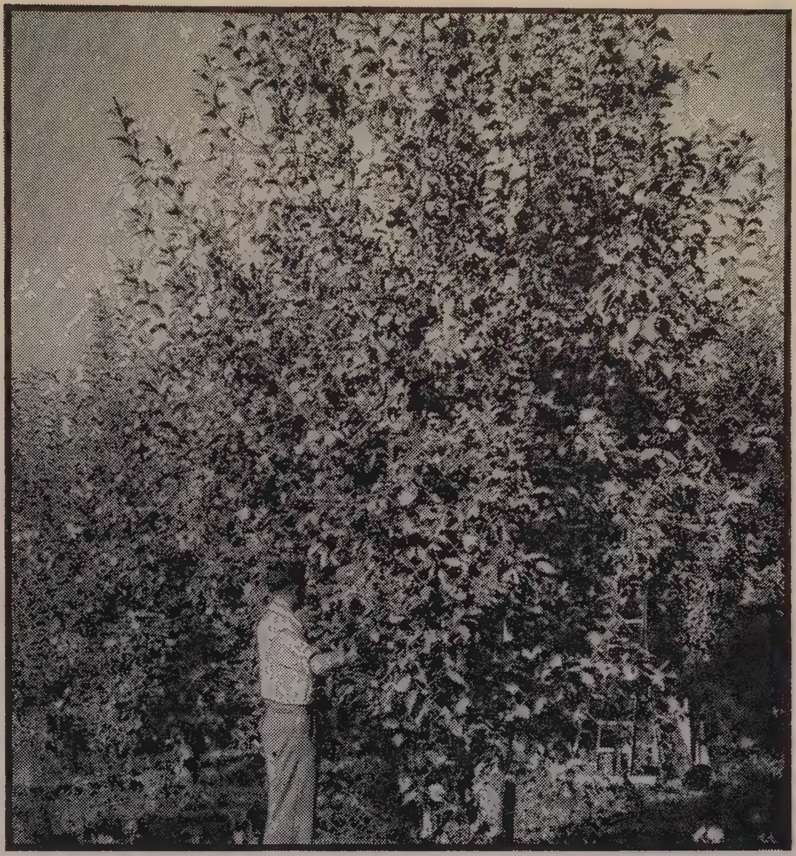
Two Main Methods of Grafting

The two methods of grafting compared in this article are hard heading-back and refurnishing or frame-working.

The refurnishing method as illustrated on page 36 consisted of utilising practically the full length of the leaders and the stubs of most fruiting arms and laterals. Surplus stubs were removed so that those remaining were well spaced to give good coverage of all leaders. The leaders were topped about 10ft. from the ground, and all cutting was done immediately before grafting. One man did all operations.

In the heading back method discussed trees were cut down to about 4ft. immediately before grafting. Five men were employed, two cutting the trees down, two grafting, and one sealing all cuts.

In both heading back and refurnishing the rind or bark graft method was used for large cuts and the whip graft for small laterals.



Golden Delicious variety refurnished on to a 26-year-old Statesman tree in October 1950. The photograph was taken in March 1953 just before a crop of 7 bushels was taken from the tree.

Advantages of Systems

Refurnishing is definitely much slower than heading back, but because the leaders are retained, a new tree is developed very quickly. Return to cropping is therefore much earlier and a greater quantity is produced than with heading back. In refurnishing the trees illustrated the grower (who was inexperienced at grafting) did 3 or 4 trees a day, putting 65 to 75 scions on to each tree. Golden Delicious worked on to Statesman in October 1950 packed 7 bushels per tree in 1953. The crop was lost for 2 seasons only, as the trees gave an economic crop in 1953.

The main advantage in the heading back system illustrated is the great saving in time. The five men referred to previously grafted over 75 trees in 1½ days. Ten to twelve scions were grafted to each tree.

Disadvantages of Systems

Practically the only disadvantage with refurnishing is the time taken in the actual operation. Another possible minor disadvantage is that much regrowth of the old variety may give trouble during the first season after grafting.

The main disadvantage with heading back lies in the possibility of disease organisms gaining entry through the large wounds. The papery-bark condition is fairly common on headed back trees and *Coriolus versicolor* (Linne ex. Fr.) Quel., a wood rotting organism, and silver leaf are two fungi responsible. A second disadvantage is that a complete new framework needs to be built up and consequently production is delayed for 5 or 6 years as against 2 seasons with refurnishing.

Age of Rootstock

The age and health of rootstock have a great bearing on the vigour of scions in the growing season and therefore on the resultant tree. The trees in both orchards discussed were all under 30 years old, those refurnished being 26 years old, and those headed back being 22 years old. It seems doubtful whether there is much value in grafting over trees once they reach about 30 years of age. Though apple trees grow well after that age, grafting over appears to reduce their thriftiness. A lot depends, of course, on the compatibility of stock and scion, which is a subject beyond the scope of this article.

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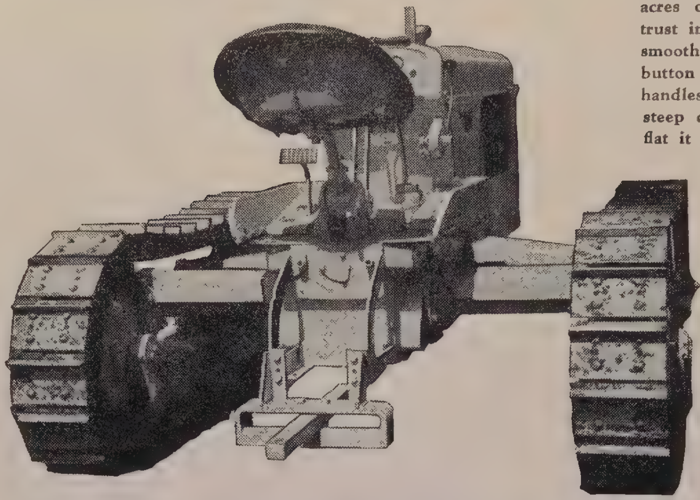

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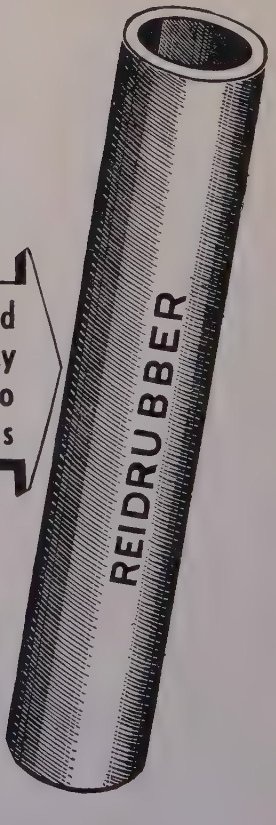

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Some Practical Aspects of Brooding Chickens

MUCH depends on a successful chicken season, during which no poultry farmer can afford to leave anything to chance. In this article F. C. Bobby, Superintendent, Poultry Industry, Department of Agriculture, Wellington, outlines under two headings, first, preparing for the chick season, and second, the brooding of chickens, the work which should be done before and during the rearing season.

SUCCESS during the season will depend largely on careful attention at both stages.

PREPARING FOR THE CHICK SEASON

Examination of Equipment

The chick rearing season is the busiest time of the year. Day-old chicks leave the incubator weekly and work accumulates as the season advances. Consequently there is less time each week to do extra jobs, and for this reason alone the wise poultry farmer will have all brooder houses and chick rearing equipment in first-class order before the first hatch of chicks leaves the incubator. Brooder houses should have been cleaned out and disinfected after last season's chick rearing, and all rearing equipment should be examined now, before it is needed. Whatever the type of brooder used, an electric canopy hover, a dull emitter infra-red unit, or an infra-red lamp, it should be checked. Water fountains should be examined for leaks and care taken to repair any damaged feeding troughs. Where wire netting frames are used under the hover care must be taken to ensure that the wire netting is taut and undamaged. It is also essential that a full set of equipment is available for each brooder pen. Nothing must be left to chance or last minute improvisation.

Management of Grass Runs

If chickens are to be given access to grass runs outside the brooder houses, the runs require attention; indeed, they should have received attention soon after the end of last year's rearing season. If there was an outbreak of coccidiosis last year, the runs should have been broken up for resowing with grass, always a sound policy in such circumstances. Areas immediately outside the pens can be dangerous, as they are most used by chickens and consequently become heavily fouled by droppings, and they should be cleaned and limed. It is frequently not necessary to break up the grass between seasons, but all too often grass and weeds are allowed to grow and prevent any direct sunlight from reaching the soil. This is a bad fault in the management of grass runs, as allowing sunlight to reach the ground where the herbage is kept short assists in the control of internal parasites. Where the herbage is permitted to grow tall and coarse the ground is shaded, remains damp, and is an excellent harbouring place for these parasites. Grass runs kept cut between rearing seasons will be in excellent condition to receive chicks in spring.

When chicks are being held for sexing care should be taken that they do not overheat in the chick boxes. When the boxes are stacked wood should be placed between them to permit circulation of air and prevent the chickens becoming overheated.

BROODING CHICKENS

Sound Stock Essential

Successful chick rearing depends first on good-quality chicks coming from the incubator. This factor in turn depends on sound breeding stock properly managed and on correct handling of the incubator. At hatching time it is important to cull out all weak or crippled chicks before the hatch is sent to the brooder house. Giving poor-quality and weak chicks a chance is unsound economically, as they rarely live to develop into normal, productive birds.

Where chicks are held for sexing care should be taken that they do not overheat in the chick boxes. This can easily occur if the boxes are stacked one on the other without pieces of wood between to allow free circulation of air (see illustration above). Chickens generate a considerable amount of animal heat and if boxes of chickens are placed directly one over the other, the temperature in the boxes is raised considerably. Many incubator rooms have special shelving on which to place chick boxes until they are taken to the brooder house or sent away to fulfil orders. Carelessness at this stage can well lead to chilled chicks under the brooder during the first few days after they leave the incubator.

Provision of Litter

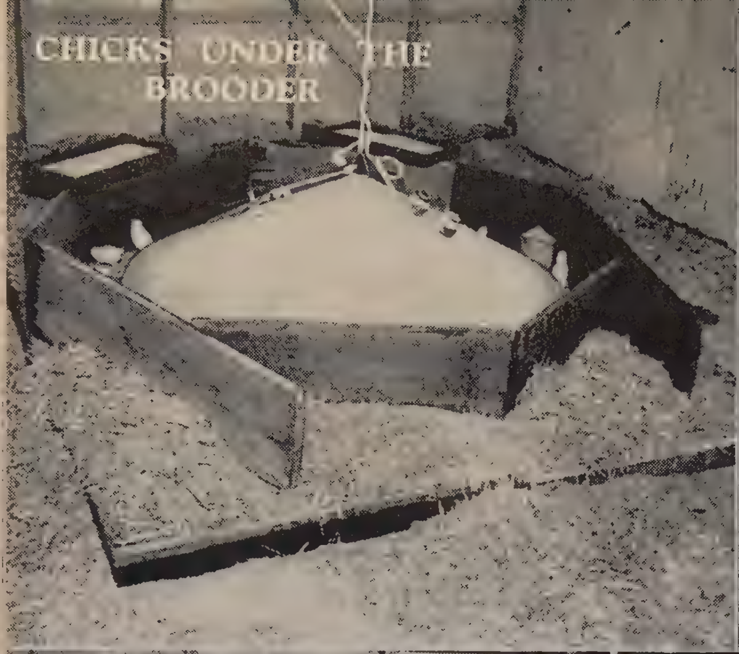
The next essential is to have the brooder house pens complete in all details before chickens are introduced. Litter must be completely dry, irrespective of the material used. Current practice is to use chopped straw, but recent research work has shown that chopped straw and wood shavings make an excellent litter for chickens. Where sand is readily available some poultry farmers use a layer of sand 1in. to 2in. deep under the chopped straw. Whatever the material sufficient should be used to prevent the chicks from scratching through to the concrete floor and to absorb readily all droppings and moisture. Damp litter in any part of a brooder house pen is a menace to the chickens and affords ideal conditions for the development of coccidiosis.

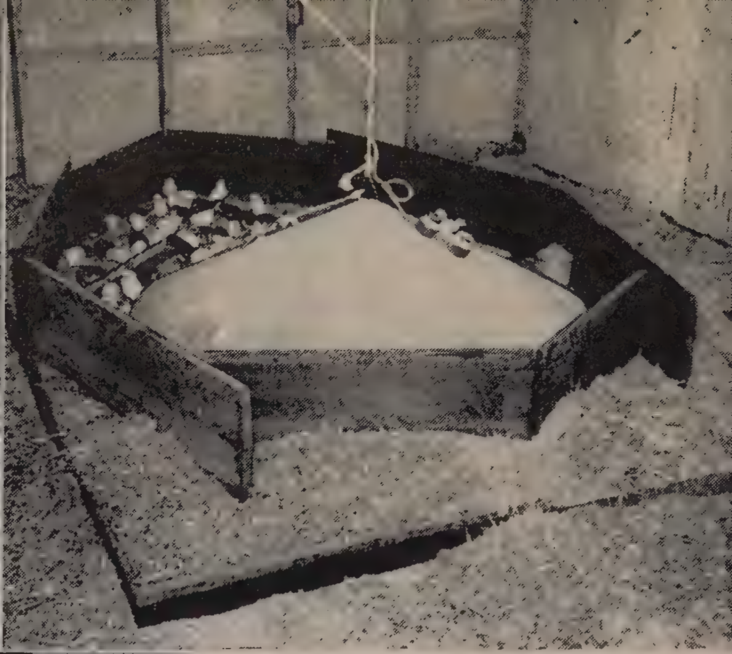
If an ordinary type of canopy brooder fitted with an electrical heating unit is used, the question arises whether the chicks should be run directly on the litter or on a wire mesh covered frame under the hover. Factors affecting this are: First, ventilation under a canopy hover is far from perfect. Second, a batch of chickens under a hover exhales an appreciable amount of moisture. Chickens do not sweat as animals do through the pores of the skin but increase the amount of moisture exhaled through the breath. Consequently if the ventilation under a hover is not particularly efficient, the air under the hover carries a heavy moisture content, which can result in damp litter. The greater the number of chickens under the hover, the more chance there is of this dampness. It is obvious, therefore, that overcrowding accentuates this condition which so easily leads to trouble.

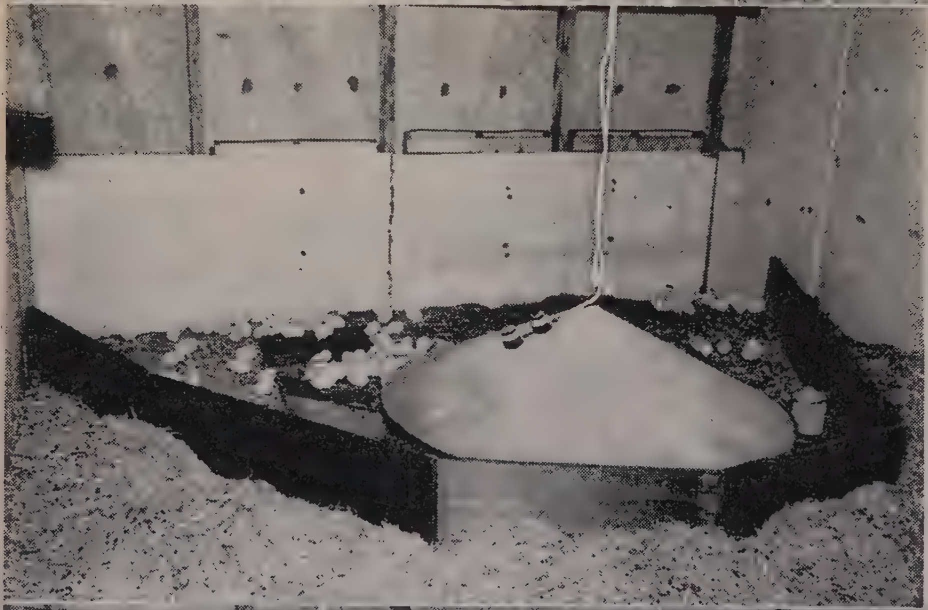
Daily Checking of Litter

If, therefore, chickens are sleeping at night directly on litter under the hover, it is essential to check the condition of the litter daily. Little or no dampness will be noticed in the early days of brooding, while the chicks are small, but as they increase in age and size it is common to find the litter damp in the morning. There are two ways of combating this trouble. One is to remove any dirty and damp litter from the hover daily and to replenish with fresh, dry litter. Another method, which can be adopted if the hover can be moved, is to change the position of the hover daily to get the chicks away

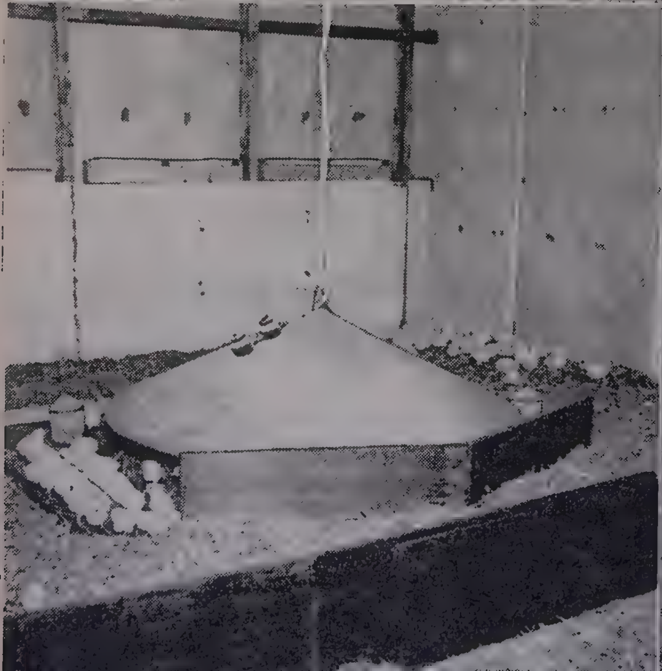
CHICKS UNDER THE BROODER

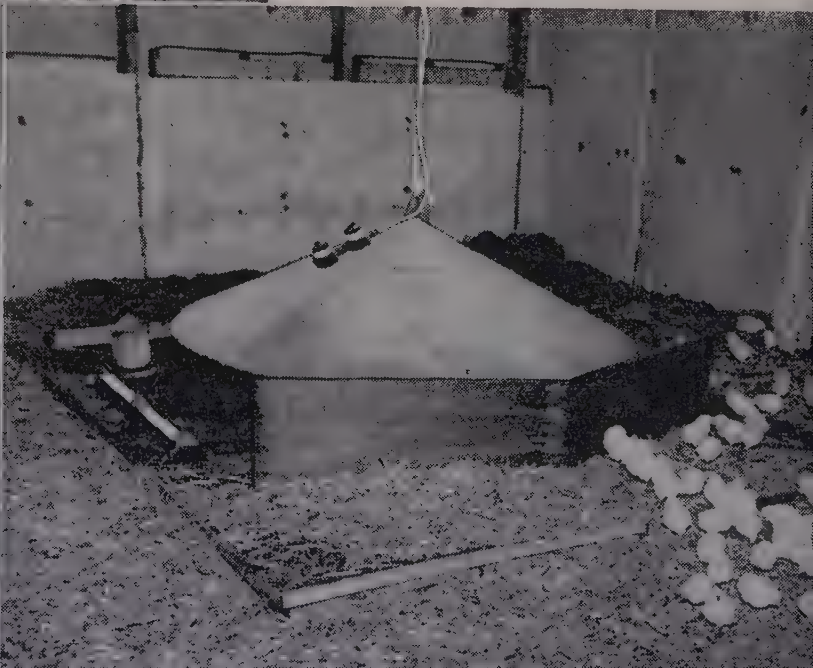


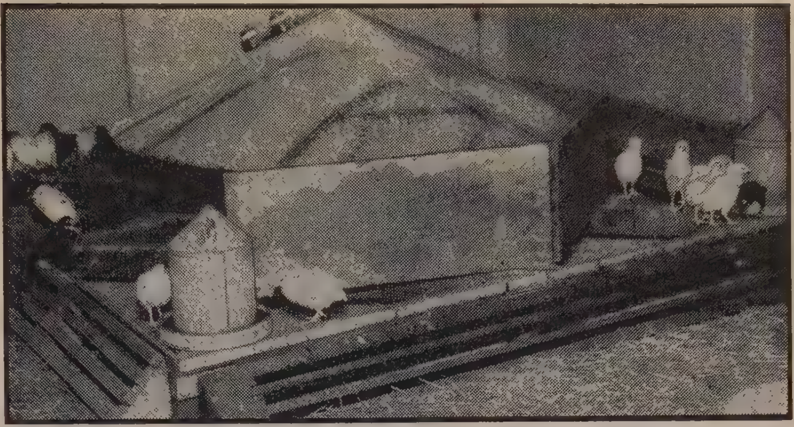




Upper left—A wooden, metal, or cardboard surround is placed close to the hover when the chicks are first put under the brooder. This prevents the chicks from wandering away from the hover and also protects them in the earlier stages from any ground draught. Note that the water fountain is available to the chicks. Upper right—During the first 2 or 3 days the surround is opened out sufficiently to allow feeding boards or small dry mash troughs to be placed close to the hover while the chicks are being fed. At left—At about the third day the surround is partially opened up. Lower left—The chicks have been given access to about half the pen, but two boards are kept in an arc immediately in front of the hover to prevent draughts striking the chicks. Lower right—The whole pen is now in use, but the two boards in front of the hover are retained.







The wire frame raised on wooden blocks and with ramps placed at the sides to stop the chicks from getting under the frames.

from the area on which they slept during the previous night. "Sweating" under the brooder, as it is termed, is highly detrimental to chickens and causes uneven growth, poor feathering, and a gradual deterioration in constitution. Particular care should be taken to avoid it.

Avoidance of Damp

An endeavour to get away from these damp conditions and to combat to some extent the inefficiency of the ventilation under ordinary canopy hovers led to the use of wooden frames covered with ½in. wire netting. In the early days of the use of these frames it was found that chicks did not take readily to sleeping on this netting and, furthermore, the temperature under the hover was insufficient for the comfort of the chicks in the first week. To counter these disadvantages sacking was placed over the frame and litter spread over the sacking. After about 10 to 14 days the sacking was gradually peeled off the netting. The use of wire frames in this manner failed to overcome the major trouble—damp litter under the hover. All too often after the first 10 days of rearing it was found that the sacking and litter had become damp; in other words no advantage was obtained, as the sacking prevented any flow of air up through the netting and around the birds. Therefore, this method of using wire frames is not recommended.

There is, however, a satisfactory method of using these frames. Instead of a sack being placed on top of the netting, the space under the netting should be filled completely with chopped straw (see illustration below). This overcomes the difficulty of holding an adequate temperature under the hover at the start and in addition there is no trouble in getting the day-old chicks to sleep on the wire netting. On about the fifth day the frame is lifted and the litter moved away, and the chicks are left to sleep on the netting. Two purposes are achieved in this way. First, air is allowed to circulate under the chickens, thus preventing any sweating and consequently any damp conditions. Second, all droppings passed by the chickens while resting under the hover fall through the netting, thus giving hygienic conditions under the hover, which in turn aid in the control of disease.

Surround and Drinking Water

Before the chickens are placed under the hover the hover is fenced in with a wooden, metal, or cardboard surround as shown in the upper left illustration on the opposite page. This surround prevents the chicks from wandering away from the hover and also protects them in the earlier stages from any ground draught. Drinkers are placed within the surround from the start, as chickens should have access to water as soon as they are put under the hover. It is good policy to place the chicks under the hover toward the end of a day, as the chicks will settle down during the night and have a complete rest. No food is necessary before the next morning, as chicks at this stage can live on the yolk absorbed just before hatching. Next morning the surround is opened out sufficiently to allow feeding boards or small dry mash troughs to be placed close to the hover as shown in the upper right illustration on the opposite page.

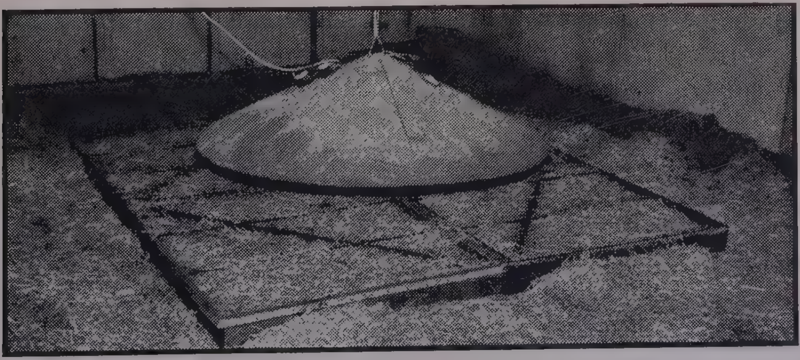
Adequate Warmth Essential

Adequate warmth for baby chicks is a first essential. Day-old chicks leave an incubator in which the temperature is approximately 100 degrees F. In the hover the temperature should be approximately 95 degrees F. at the edge of the hover. The temperature can be checked with a thermometer before the chicks are put under the brooder, but thereafter the chicks themselves will quickly indicate whether the temperature is adequate or otherwise. With the ordinary canopy type of electric brooder there should be an excess of heat under the electric element at the centre of the hover, thereby causing the chicks to spread out in a circle toward the edge of the canopy. As the days pass the chicks will get further away from the centre. The ideal after a few days is for the chicks at night to be in a wide circle under the hover with their heads just visible around the edge of the canopy and their tails toward the centre. At no time should chicks huddle together or crowd toward the centre of the hover. If they do, there is either insufficient heat under the hover or there is a cold ground draught which is driving the chicks toward the centre of the hover in an endeavour to keep warm.

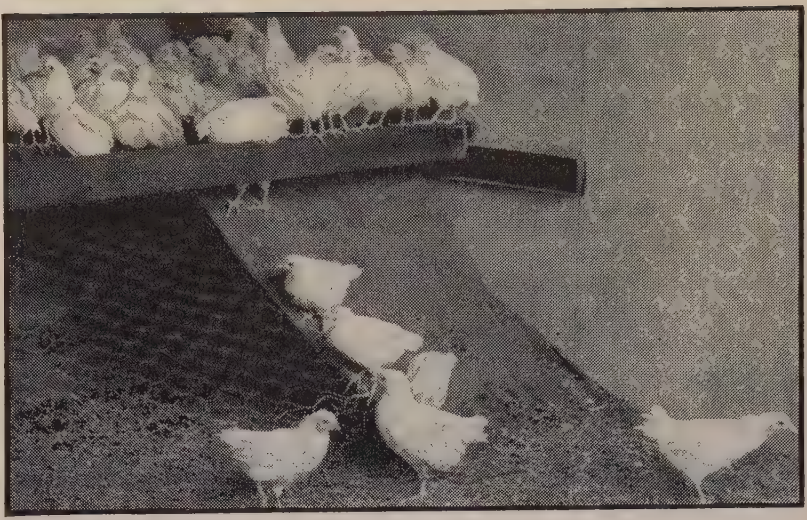
In general, and within reason, it is better to have an excess of heat under the hover at the start, provided the chicks can get away from it toward the edge of the canopy, than to have barely sufficient heat, when the chicks will tend to huddle toward the centre, where the ventilation is least efficient.

Many metal canopy hovers can be raised or lowered by being hung from a beam with a counterpoised weight. At night when all the chicks are under the hover they are generating animal heat in addition to the artificial heat supplied. Thus the hover can be slightly higher at night than in the morning when the chicks come out to feed. On cold mornings the hover should be lowered a little and if necessary the heat from the electric unit increased so that chicks returning from a feed can obtain a quick warm up.

On the third day the surround can be opened out to allow the chicks to run into a part of the pen as shown in the middle left illustration on the opposite page. It is usual to allow them to run out into the back half of the pen by placing the surround across the pen in front of the hover (see the lower left illustration on the opposite page). Finally chicks may be given access to the whole pen, but it is sound practice to leave a portion of the surround in the shape of an arc in front of the hover (see lower right illustration on the opposite page) to prevent draughts from the front of the house affecting the chicks.



Two wire frames each measuring 7ft. x 3ft. are placed under the hover. Note that the space between the netting and the floor has been tightly filled with straw litter.



Chickens led on to perches by a netting and sack ramp, the stage before they are transferred to range for the growing period.

Control of Heat

Electric hovers usually have heating units wired to give three intensities of heat—high, medium, and low. It is difficult to advise on how these intensities of heat should be used. Obviously much will depend on the weather at the time and, of equal importance, the wattage of the element. In general, however, high is used only for a short time when the chicks are first put under the brooder. For the next 14 days the medium heat is usually sufficient. After a fortnight if the weather is normal, the low heater can be used for another 2 weeks, the aim being to harden the chicks off from heat by the time they are about 4 weeks of age. Experience will be gained if the chicks are watched carefully at all stages, the height of the hover and the amount of heat used depending on what the chicks themselves indicate they need. The object is to harden the chicks off as soon as practicable consistent with common sense.

At about 3 weeks of age the chicks will have grown considerably, and where wire frames are used it is an advantage to raise the frames by placing blocks of 3in. x 2in. wood under their corners as shown in the upper illustration on page 29. This allows a freer flow of air under the chickens which are being hardened off and also gives greater room under the frames for droppings. At no time should the droppings be allowed to accumulate under the frames until they touch the wire netting. All too often this point is neglected, largely because the chicken raiser fails to lift the canopy to look at the conditions underneath.

Finally, when the heat is turned off between the fourth and fifth week of age the birds can be left to sleep on the wire frames (the canopy being left in position) or be gradually driven up on to broad perches as shown in the illustration on this page. They must not be allowed to sleep huddled together in heaps in corners on the litter, as this leads to overheating and sweating at night, which are most detrimental to the health and constitution of the birds.

Feeding

Good chickens can be reared on dry mash and grain from the start. Small, dry-mash chick hoppers can be placed within the surround on the first morning after the chicks are put under the hover. In addition to the mash the chicks should receive three grain feeds daily at equal intervals during daylight. This grain may be fed on wooden boards or cardboard, the metal surround being opened out slightly to allow these boards to be placed on the wire frames. The chickens are given about 15 minutes in which to eat the grain, when the boards are removed and the surround closed in again. Later, when the chicks are given access to the pen by removal of the surround, the grain may be fed on the litter to encourage exercise by scratching.

Vitamin Requirements

Standard chick mash No. 1 can be fed during the 6 weeks in the brooder house, but since this mash contains only 10 per cent. of meat meal, it is advisable to reinforce it with between 5 and 8 per cent. of milk powder, preferably dried buttermilk powder because of its high riboflavin content. Furthermore, it is essential to add a feeding oil to this mash, unless of course the mash manufacturers have already added oil or synthetic vitamins. Chickens require both vitamins A and D in their ration and these can be supplied by mixing in just less than ½ pint of a feeding oil containing 2000 units of vitamin A and 200 units of vitamin D to every 100lb. of mash. If the oil contains only 1000 units of vitamin A and 100 units of vitamin D, the amount of oil should be increased to not less than ¾ pint per 100lb. of mash mixed. This feeding oil must be evenly distributed throughout the mash, which should be used up within a week of being mixed if possible. As a gradual loss in vitamin content occurs after the oil is mixed into the mash, mash containing oils should not be stored for long periods.

Though chickens may receive an adequate quantity of the necessary vitamins in the oil added to the mash, they benefit from daily feeds of finely cut young green food such as young grass, young oats, and silver beet. For White Leghorns a proper supply of green food will ensure good leg and beak colour.

To assist the food grinding process in chickens' gizzards hard grit is necessary. Chickens which are confined to a brooder house must therefore be supplied with a fine, hard metal grit, lack of which will result in poor digestion. Chickens running outside will endeavour to rectify this by searching for small stones. Suitable grit for the gizzard is therefore another essential if the best results are to be obtained during the rearing season.

In the early stages grain for feeding with the mash is given in two grades; No. 1 chick grain or feed is suitable for approximately the first fortnight, and No. 2 thereafter. Chick grains or feeds are usually made up of a mixture of wheat, groats, and maize in the appropriate sizes according to the age of the chicks. By the time they are 5 weeks of age chickens will readily eat whole wheat.

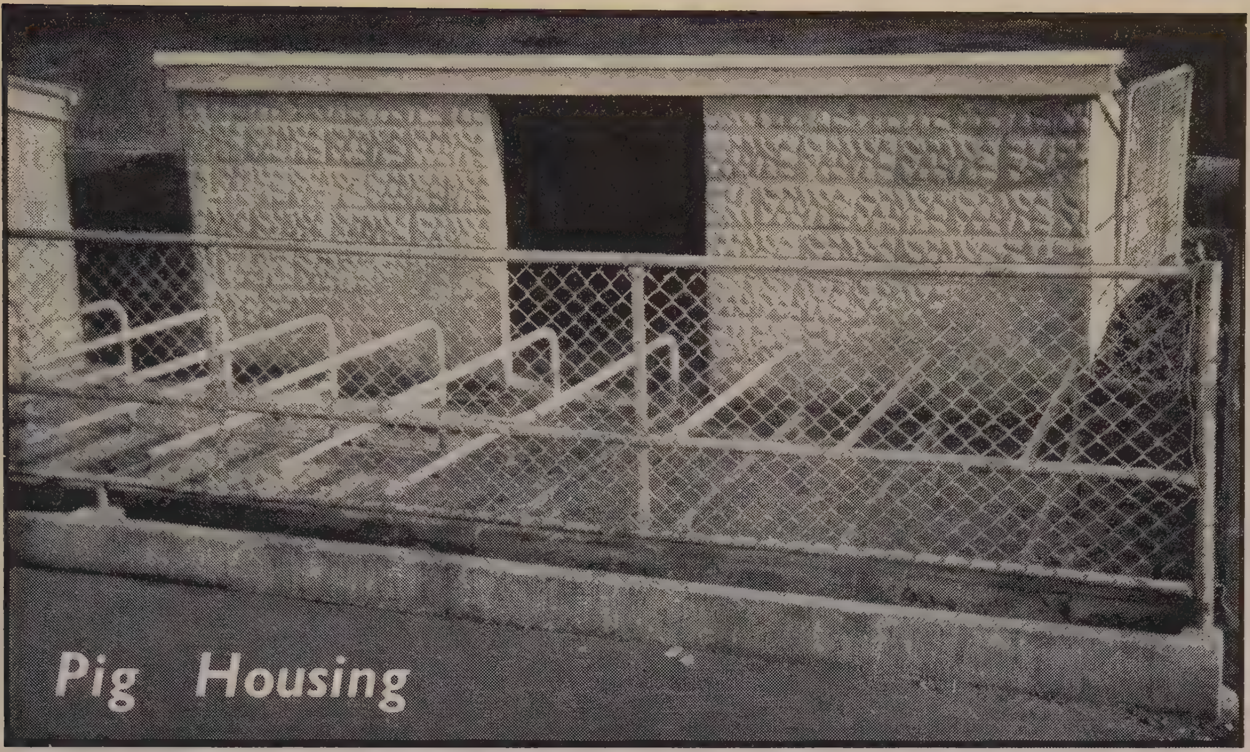
Transference to Growing Houses

The age at which young chickens may be transferred to growing houses, such as range shelters on free range, will depend on weather at the time. Poultry producers differ regarding this matter, some liking to get their birds on to range by 5 weeks and others considering 6 to 7 weeks early enough. Much will depend on the feathering of the birds, but the guiding principle should be that chickens must not be checked by this move. It is particularly desirable to avoid any check during the rearing of chicks. Once chickens have received a check, either from disease or poor management, it is doubtful whether it can be made up and first-quality birds reared.

As the rearing season advances and work increases there is a tendency to give less detailed attention to the later hatched chickens. The first batches receive the enthusiastic attention associated with a new chick rearing season. Enthusiasm wears off and tiredness creeps in as the later hatches go into the brooder houses. These later hatched birds, which so often receive less attention than the earlier ones, are often the first to contract disease such as coccidiosis.

Rickets in Poultry

VITAMIN D, known as the "rickets preventing" or sunshine vitamin, is essential to young chicks for normal bone development. Chicks denied daily exposure to sunlight by intensive rearing or prolonged cloudy weather require vitamin D added to the diet, and it is advisable to use fish liver oils containing this vitamin as a routine supplement. The amount added varies according to the potency or strength of the oil, that is, up to ¾ pint of an oil containing 100 units of vitamin D per gramme to 100lb. of mash, or half that quantity of an oil containing 200 units of vitamin D.

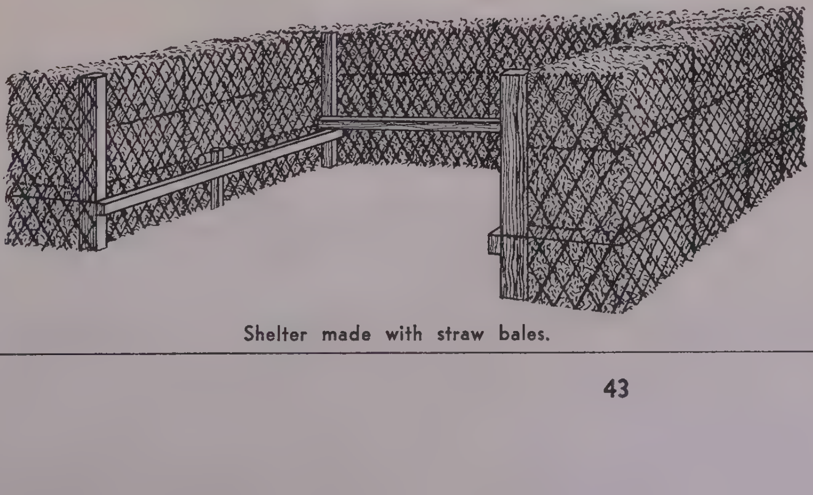


Dry-sow Houses, Temporary Housing, and Piggery Facilities

THOUGH the permanent and somewhat expensive types of housing dealt with in the earlier articles of this series on pig housing are economically justifiable for the major part of the piggery layout on most developed dairy farms, there are purposes for which other types of house, sometimes quite cheap and temporary, may be preferred. Dry-sow housing, though permanent, may be simple and inexpensive. The inclusion of yards and facilities for handling pigs must be considered in the design of any piggery and these aspects are covered in this final article of the series. It is by A. Longwill, Superintendent, Pig Industry, Department of Agriculture, Wellington.

DRY sows can secure a considerable proportion of their total food requirements from grazing under New Zealand conditions where high-quality pasture is available over a large part of the year. As a result sows are often accommodated in wooden houses away from the main piggery and allowed to range over one or more of the cow paddocks. The house itself may be built either on permanent foundations in some sheltered situation or on runners so that it may be moved from paddock to paddock.

Good draught-proof wooden shelters providing 10 to 12 sq. ft. of floor area per sow and with a wall height of 4ft. to 5ft. placed to face between north and east, depending on local weather hazards, and in a dry but sheltered position will usually be satisfactory. The actual design will vary considerably according to the climate and the materials available and may range from a temporary, straw shelter to well-built, durable timber houses designed to meet the variations in climate normally experienced.


Shelter made with straw bales.

Straw Shelter

In districts where baled wheat straw is plentiful suitable shelters can be constructed along the lines of the lower illustration on this page. Thirty bales are used in the type of shelter shown, though in some districts it may be preferable to close in the front to some extent, when a further 6 or 9 bales may be used. Bales which are tied with wire are preferable.

Posts in each corner give rigidity to the structure and hold the wire netting, which is strained round the inside before the bales are placed in position. The netting prevents the sows from tearing the bales to pieces. The bottom row of bales is held in position by straining a No. 8 wire from one of the front posts right round the outside of the bales to the other front post. If shelters of this type are used as farrowing houses, a farrowing rail may be built on to the corner posts as shown in the diagram.

A timber framework for corrugated iron or other type of roof may be secured by No. 8 wire threaded through from the bottom row of bales and passing under the tie wires of all bales. Where a straw roof is preferred it should be built on a wire netting base laid over strong bearers wired on to battens placed on the bales forming the sides of the house.

HEADING PHOTOGRAPH: Permanent house for dry sows built with hollow concrete blocks; this house is in the main layout of a modern piggery. Feeding bails are built over the trough to prevent fighting among sows.

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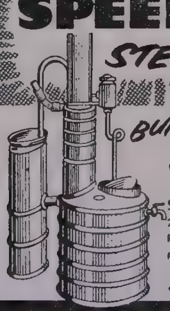

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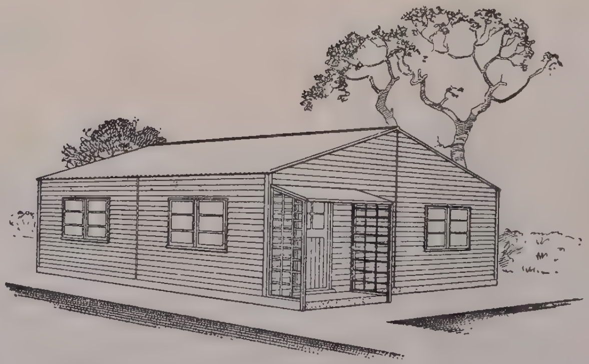

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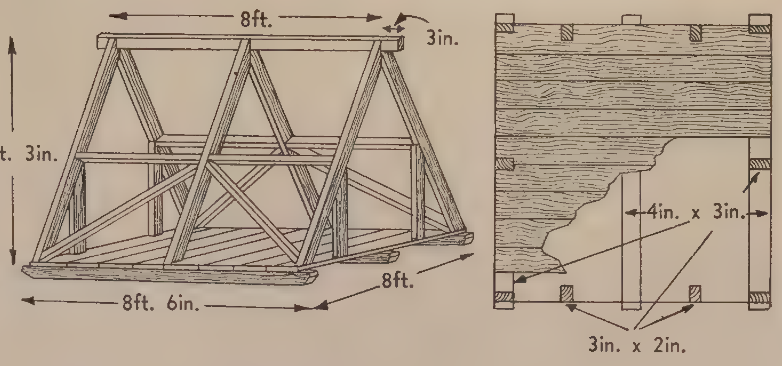
A dry situation with good drainage must be chosen for shelters made with bales. An earth floor is suitable under these conditions, but a wooden floor may be provided or the bales may be laid on a permanent concrete floor. Though these shelters have the disadvantage that they harbour vermin, fleas, and other pests, they may be stripped easily, the straw burnt, and the shelter rebuilt whenever necessary.

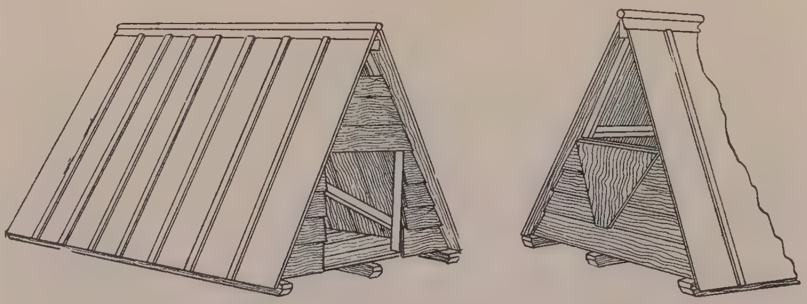
Movable Timber Houses

Movable timber houses should combine light weight with rigidity, and no design surpasses the A type in this respect. In relation to the floor area the design effects a desirable reduction of contained air space, but must have ventilation openings at either end under the apex to prevent it from becoming uncomfortably hot in the hot summer weather.

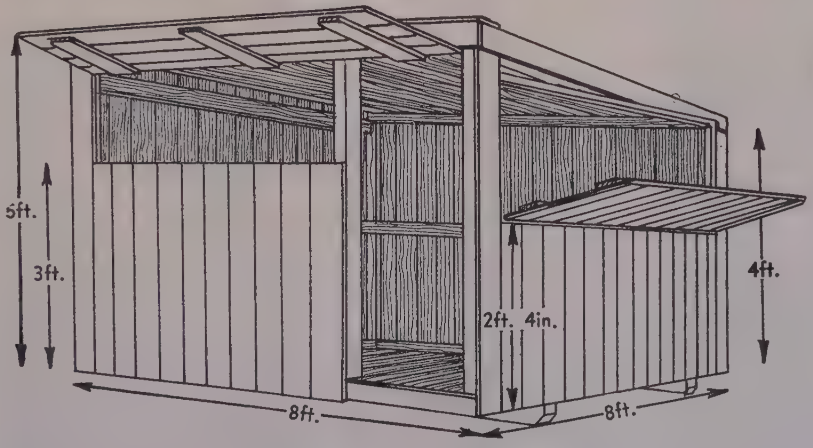
It is better to have several small houses on 8ft. x 8ft. bases than to build a large house to accommodate all the sows together. Large houses are awkward to move and therefore are not moved as often as they should be and are more liable to be damaged in the process. The upper diagram on this page shows a suitable design for the A type of house, which may also be used as a farrowing house if the occasion demands.



Movable timber house of the A type with ventilation opening under the apex.



A more elaborate and costly house with shutters to afford ventilation or access when necessary or to enable the house to be closed snugly in cold weather is shown in the illustration below. The control over temperature will be effective only if proper use is made of the shutters, and it will be possible to build more generally comfortable quarters if a permanent house built with proper attention to insulation of roof, walls, and floor is erected.



Timber house on runners suitable for dry sows or occasional farrowing. Shutters enable temperature to be controlled and facilitate handling of a sow at farrowing.

Permanent Sow Houses

In some modern piggeries the dry-sow house is built as an integral part of the piggery with the same degree of control or free run as is provided for all houses of the layout. Thus though free range on grass is generally allowed, the sows come in to the main feeding centre and are fed at their trough, which should be provided with bails to avoid bullying of the younger or lighter sows, which require extra feeding, by the stronger, heavier sows. The latter may require to be severely rationed on their intake of milk and to do this effectively it is desirable to have the trough subdivided so that each sow may be fed according to her requirements. The illustration at the head of this article shows a concrete house with trough provided with feeding bails.

Piggery Facilities

Drafting Yards and Loading Ramp

Pigs are not easy to handle unless properly planned facilities are incorporated in the layout. The race connecting units in a multi-unit layout along which pigs are worked should lead direct to yards in which the pigs can be held and drafted and from which a loading ramp provides a convenient means of loading on to a truck. A weighing crate and a crush race with head bail will usually be included and a foot bath may also be provided.

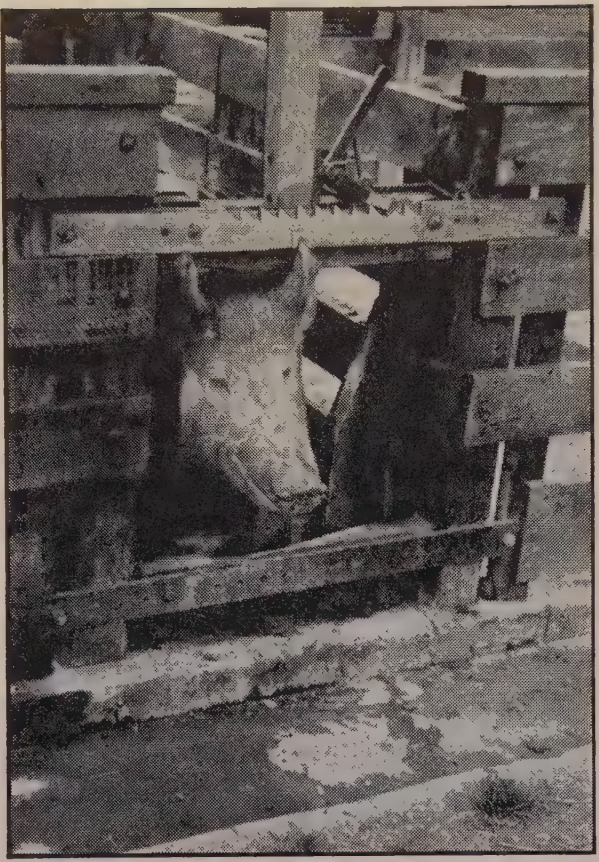
The design will vary according to the layout of the piggery as a whole, and the extent of facilities provided may vary from a small yard with loading ramp to a full range of the facilities which help to reduce labour.

A plan of a complete set of yards suitable for the dairy farm piggery is shown in the diagram on the next page. If the principles of the design are appreciated, it will not matter if some rearrangement is effected to suit a particular site or layout.

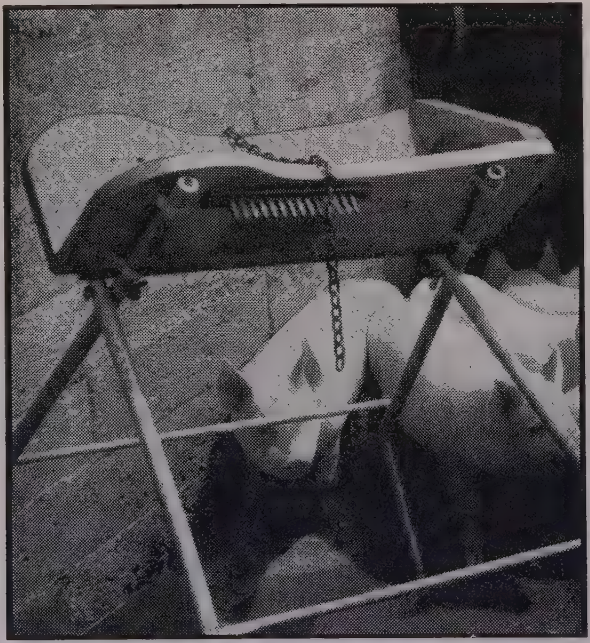
The main points in the plan are:—

1. The whole arrangement is compact.

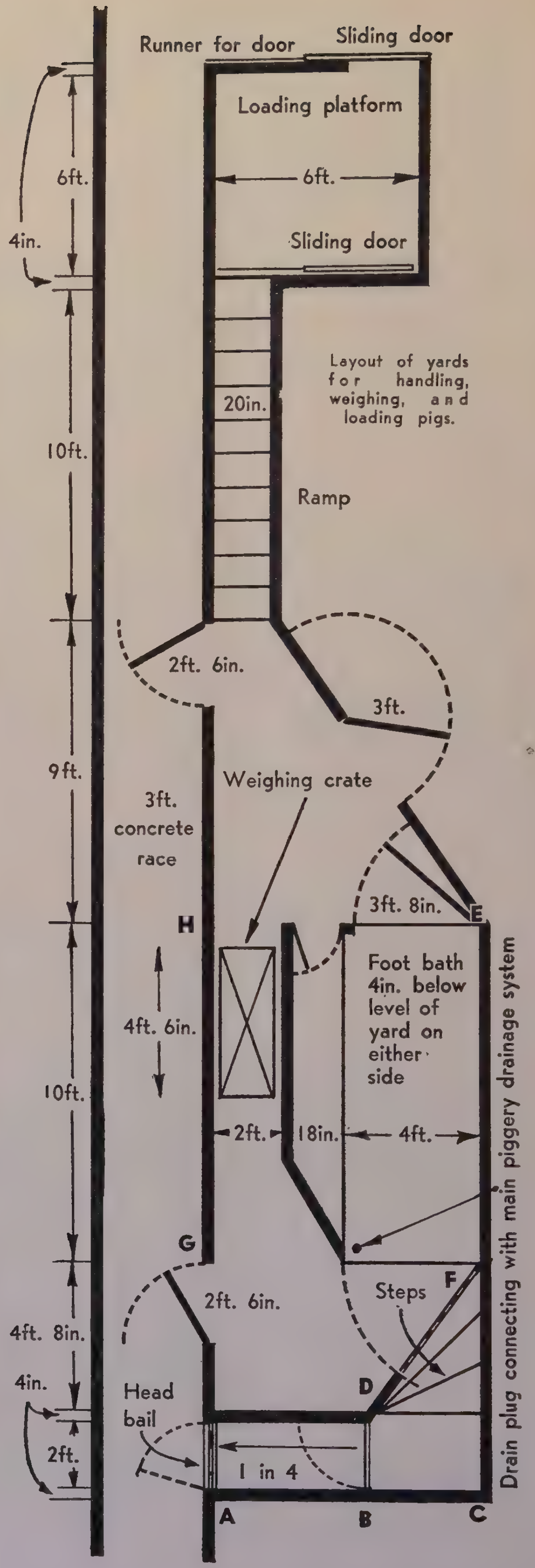
2. The level and falls are arranged to permit drainage (including drainage from the foot bath when it is being emptied) to connect with the main drainage system of the layout.



A strongly constructed head bail with ample adjustment, both at top and bottom, for pigs of various sizes.



Castrating cradle.



Layout of yards for handling, weighing, and loading pigs.

Runner for door
Sliding door
Loading platform
6ft.
Sliding door
6ft.
4in.
20in.
Ramp
10ft.
2ft. 6in.
3ft.
9ft.
Weighing crate
3ft. concrete race
3ft. 8in.
E
H
Foot bath 4in. below level of yard on either side
4ft. 6in.
10ft.
2ft.
18in.
4ft.
Drain plug connecting with main piggery drainage system
G
F
2ft. 6in.
Steps
4ft. 8in.
4in.
D
Head bail
1 in 4
2ft.
A
B
C

3. The foot bath and weighing scales and crate are roofed over.

4. Access gates from the race are provided at both ends.

5. The shape of the pens is designed to facilitate drafting and loading.

6. By a series of steps the corner at C is built up and the crush race AB is provided with a steep fall (1ft. in 4ft.) toward the head bail. A gate BD, hinged at B, can be used to close the rear of the crush race when necessary.

7. The ramp, of 10in. steps with 4in. risers, gives access to a holding platform, which should be covered but well ventilated to give pigs protection if they are held awaiting the carrier in hot weather. The floor height of the platform must be fixed in relation to the height of the truck decking and the level of the road on which the truck approaches the platform.

8. Weighing crate. A later article will deal fully with weighing crates and their use in efficient pig management.

9. The foot bath and weighing facilities are roofed over (area EFGH).

Crush Race and Head Bail

A good design of head bail is shown on the opposite page. The bail must be placed so that the head of the pig when held is accessible from both sides, as this is necessary, for instance, when a boar is being detusked. If, as already described, the floor of the crush race has a steep fall toward the head bail, the pig finds it difficult to pull back and is more easily held in the bail and cannot place so much strain on it as it could if the floor were level. It is preferable, in building this type of crush, to use reinforced concrete walls with smooth plaster internal surfaces. The sloping floor also should be plastered to give a smooth surface.

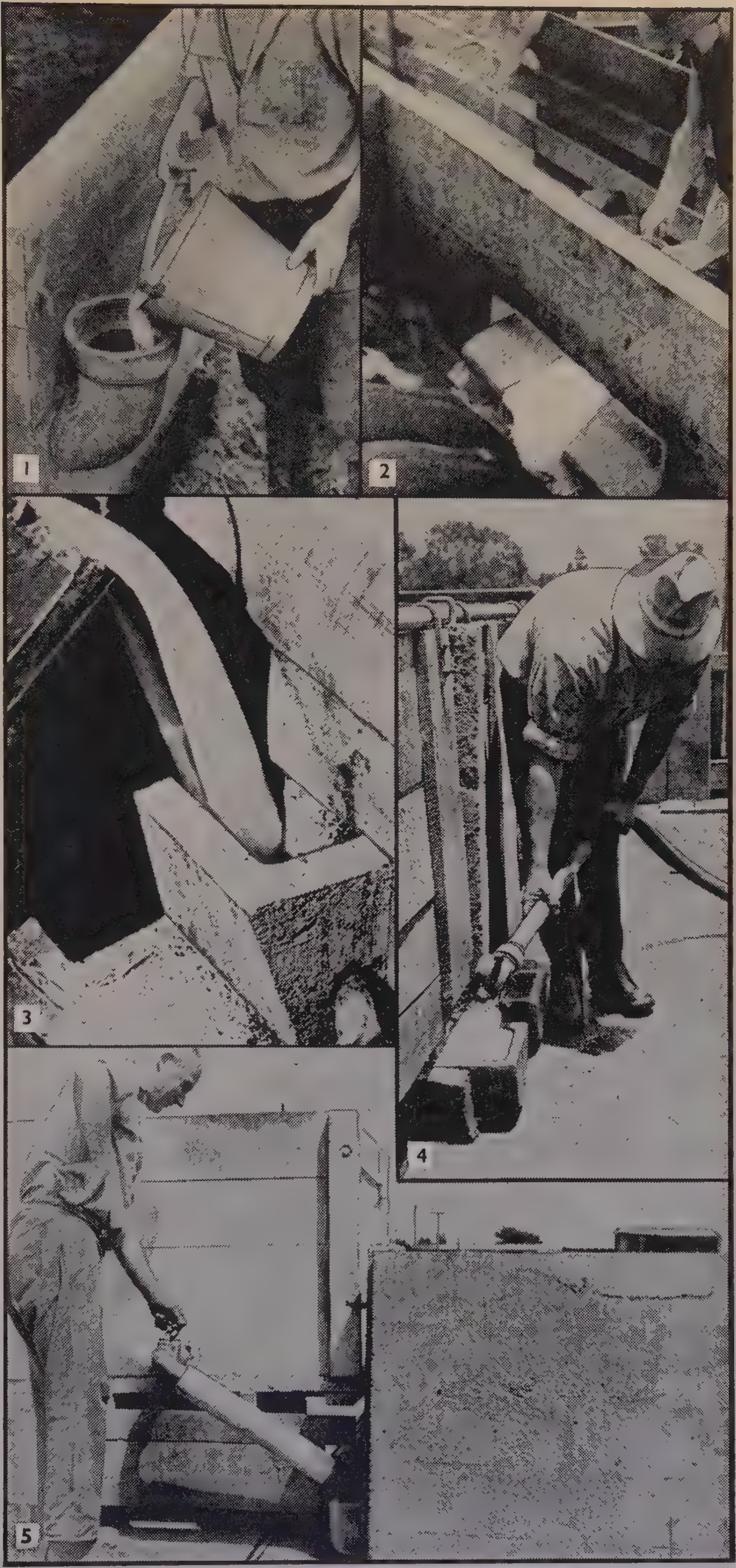
Castrating Cradle

For the man working single handed a cradle in which pigs can be held for castration is a simple aid to ensure that the job is carried out when it should be. The handy man can construct a suitable cradle, though the one illustrated on the opposite page is a factory-made article which is marketed at a reasonable price.

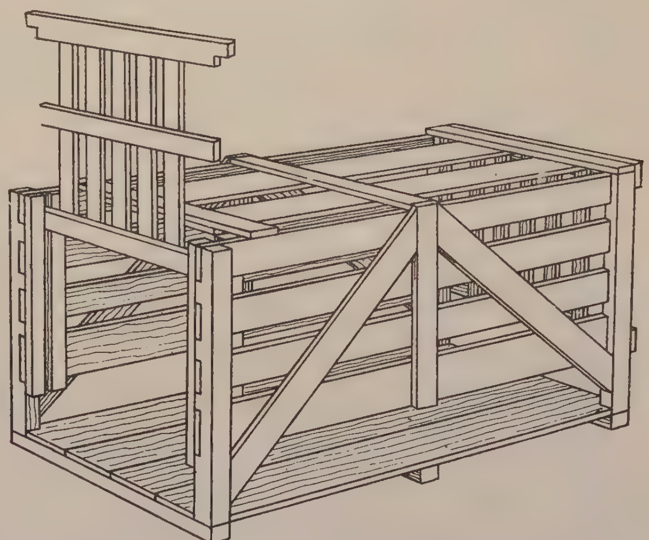
Design to Facilitate Feeding

No-one appreciates having skimmed milk spilt on to dungarees and into gumboots and it is therefore essential that provision be made in the layout for quick, easy, and clean trough filling under all conditions, including meal supplementing. Designs which provide best for these requirements are those where troughs are placed under the front fences or walls of the feeding areas. Several examples of these designs have been illustrated in this series of articles, notably in the April and June issues of the "Journal".

In other designs, or where the trough is placed up the side of the feeding area, chutes of various types,



At right—Various means can be used to facilitate liquid feeding. 1, 2, and 3—Simple chutes for bucket feeding. 4—Hose connection to main pipeline. 5—Milk container on trolley with pipe feed direct to troughs. "New Zealand Farmer" photos.



Farrowing crate of the type described in this article.

are illustrated of which some on the previous page, are used or the end of the trough projects under the wall so that the milk or whey can be poured in from outside the pen. Where pipe feeding is practised the outlet may be placed over the centre of the trough or over the end projecting through the wall. Because quick - acting valves, which are essential for pipe feeding, are expensive, attachment of such a valve to a hose serving a number of troughs, as shown in illustration No. 4 on the previous page, is a useful arrangement.

Meals are expensive but indispensable to efficient litter production and weaning. Their use will be profitable provided they are carefully stored and used with discretion. A rat-proof feed house should be provided on most dairy farms. Bins holding two or three bags of at least two different kinds of meal should be built in. The bottoms of these bins should be built up at least 1ft. above floor level with a rubble filling underneath to prevent dampness rising in the walls. A vermin-proof lid should be provided.

In larger commercial piggeries a roomy feed house with a raised platform on which sacks of feed can be stacked and trolleyed as required, a mill for grinding grain, bins to hold the meals, and a feeding barrow will be warranted. On the smaller dairy farm pig units a couple of oil drums provided with a watertight cover can be used for storage until more permanent equipment is warranted and can be financed.

Wallow or Shower

Because it has no sweat glands in its skin, the pig under natural conditions achieves comfort in hot weather by getting its skin wet or coated with mud. In hot climates where pigs are on free range properly designed wallows are frequently recommended. However, under conditions of housing pigs generally recommended for New Zealand such wallows are not required, except possibly for dry sows running out on pasture.

Fattening pigs and sows, too, where they are housed on concrete, can be kept cool in their houses by spraying a shower of water over the feeding yard. The cooling effect of this on the surrounding air ensures that the pigs lie in comfort on their beds. They will come out occasionally to have a shower. As long as this system is used judiciously and the water turned off just before the temperature drops to the level at which the pig is comfortable (so that by the time all water has evaporated the temperature will not be unduly below optimum) it will provide the best means of keeping pigs cool during the heat of the day. Since it is desirable to have water laid on in any case, the cost of the system is negligible. Also as pigs are comfortable in their houses, they do not tend to wallow in their filth or to seek a cool position under a draughty hedge as pigs on free range are inclined to do.

Service Crate

Where it is desired to mate a young sow to a heavy boar, as may occasionally happen, particularly in pedigree breeding, a service crate can be most useful.

The essentials are a crate to hold the sow and footrests attached along the inside on either side to take the weight of the boar.

Farrowing Crate

Some control over the sow at farrowing by a crate or partition across the floor of the farrowing house is very popular in overseas countries and the use of this form of insurance against losses at farrowing could be justified in many instances in New Zealand.

It should be used in conjunction with an infra-red heat lamp. Some models have a brooder attachment on either side so that piglets have ample opportunity to keep warm at a safe distance from the sow. The over-all dimensions of the crate illustrated on this page are length 8ft., width 3ft., height 3ft. 6in. The clearance between the floor and lowest side board is 10in. except at the head of the crate, where the end is the full depth of the crate. This prevents the sow from lifting the end and damaging the crate or from getting her head trapped while she is lying in the crate.

Brooders

Heat lamps have quickly proved their worth in reducing losses among pigs at birth and are now regarded, with the creep, as an essential of farrowing house design. A central situation appears to be the logical position for a brooder in any farrowing house, provided the brooder is designed so that the sow cannot toss it around. Alternative positions that are satisfactory are a corner or along the side of the house under the farrowing rail, the latter being used in many farrowing houses.

Most users of 250 watt infra-red lamps make no attempt to save electric power by conserving the heat generated and, in fact, lamps of this power would soon make an enclosed brooder unbearably hot. However, after piglets are 2 days or so old the pig's mechanism for adjusting itself to temperature changes will come into operation if given the chance, and it seems reasonable to expect that on all but the coldest nights the litter should be able to keep themselves warm enough if they are given a small insulated hay-box type of brooder without artificial heat.

Trials of types of insulated but unheated brooders which may be a means of achieving satisfactory low-cost rearing are being carried out this winter.

Weaning Coop

It is well known that pigs after being weaned find difficulty in cold weather in keeping themselves warm in a house the cubic capacity of which is 20 cub. ft. or more per pig. A practice of restricting the sleeping quarters may be partially successful in encouraging the pigs to keep clean, but unless it is enclosed, this restricted area does not enable the pigs to retain sufficient warmth to be comfortable.

A light coop of 4ft. x 4ft. floor area which can be securely fixed in the sleeping quarters will provide the desirable control over heat loss that will enable the pigs to avoid the check which is all too common at weaning. A coop with an entrance of 12in. x 18in. and a total height of 2ft. 6in. that is reasonably well insulated will achieve the desired results. It may be removed after a few weeks, when any liability to post-weaning check is past.

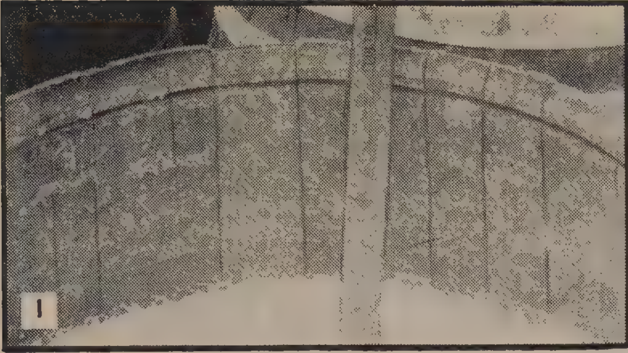
Improvement of Existing Houses

After studying recent findings in pig housing requirements many producers, including some who have built permanent piggeries in recent years, will realise that something can be done to improve the results they are obtaining.

Attention should be concentrated on making conditions on the sleeping bed comfortable at all times for the pig. This will be achieved most readily by providing shutters or other means of enclosing this area and by improving the insulation of the roof over this enclosed portion.

Extra timber in the form of dwangs between the rafters may be needed to support insulating board or other forms of lining. This should then be painted with a light coloured, glossy finish interior paint.

In the adaptations of the Danish ground plan which have been built with a wall height of 7ft. and upward, some provision for winter warmth is necessary. Well-built timber covers placed over the sleeping quarters or strong timber framework on which hay or straw is stacked will enable the small pigs usually kept in winter to keep warm and thrive.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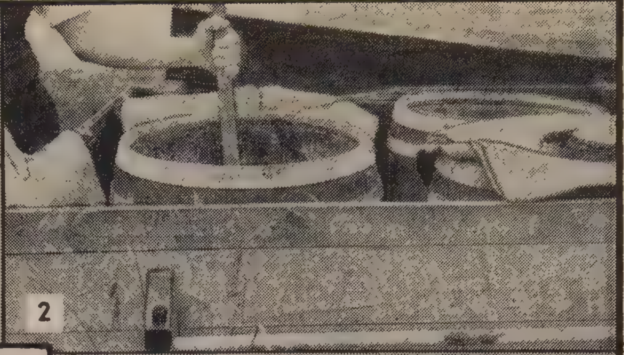
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Curd Feeding to Poultry

ON a number of farms in New Zealand poultry are kept as a sideline and on some of these farms separated milk is available. This article by the Animal Industry Division of the Department of Agriculture reviews the value of curds in poultry feeding and describes how the curds should be prepared.

THE object of curd feeding to poultry is to reduce to a minimum the use of purchased foods. In particular curds replace purchased protein-rich feeds, such as meat meal, which at present tend to be in short supply. Liquid separated milk contains only about 10 per cent. of dry matter, but when it is converted into a dry curd the dry matter content is increased to some 20 per cent. or double the amount present in the same weight of separated milk.

The dry matter of separated milk, moreover, is mainly protein, milk sugar, and ash, but the dry matter of drained curd is largely protein, for most of the milk sugar and ash have been removed in the whey, which is therefore valuable for feeding to pigs along with other foods.

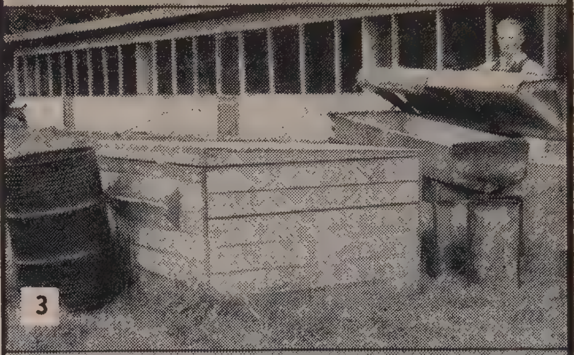
Because drained curd is a protein-rich food, foods rich in carbohydrates should be fed with it to balance any ration containing curd which is fed to poultry. Maize is a valuable food for this purpose, as it contains approximately 70 per cent. of carbohydrates (starch).

Making the Curd

During 1938-40 the Department of Agriculture conducted an experiment at Ruakura to find a satisfactory method of preparing and feeding curd to poultry. Details of the preparation of curd in this experiment are as follows:—

The separated milk is curdled in wooden barrels (Figs. 1 and 2) which are housed in a wooden box (Figs. 2 and 3) to maintain the temperature of the curdling milk. Most rapid curdling takes place when the milk is kept warm, so that it is best to pour the milk into the barrels while it is still warm after it is separated. In cold weather the temperature inside the box can be maintained by a lighted hurricane lamp placed inside the box between the barrels. Some soured milk or some whey may be used as a starter when curdling is first started, but the small amount of whey left in the barrels thereafter is sufficient to maintain curdling.

When a good, hard curd has formed, sufficient for at least the following day's feeding is put into a draining box to dry. The draining box (Figs. 2, 3, 4, and 5) is 2ft. by 4ft. and 9in. deep, with a sloping V shaped bottom like a cheese vat (Fig. 5), and with a plug at the lower end. The box is in the open to allow wind access and is covered with a removable ridged roof to keep out rain and animals. The triangular ends of this cover are fitted with bird netting to let the air circulate. Wire netting is sufficient cover in fine weather, but it is desirable to have a solid lid for protection during bad weather. The curd is placed at the raised end of the box so that the whey may drain off into a receptacle where it is collected for the pigs. It is highly desirable in curd feeding that the curd should be firm and dry. If the whey is not drained off efficiently, what remains in the curd is liable to loosen or ultimately scour poultry, the whey being acid.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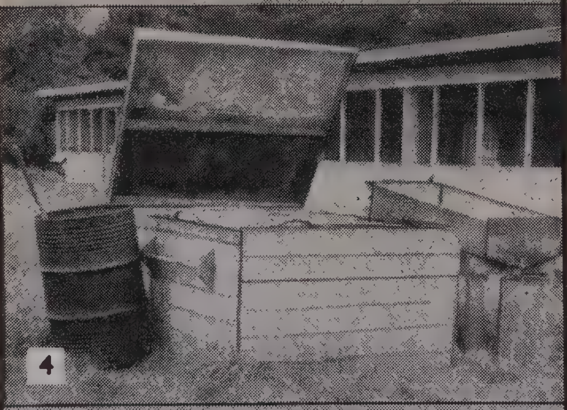
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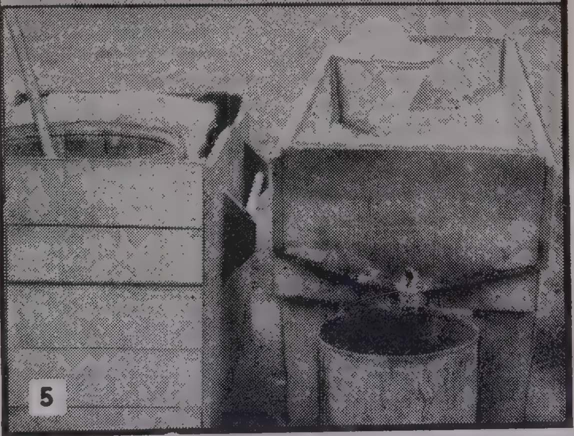
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50—FEEDING CURD TO POULTRY

From September to March a high proportion of curd may be fed to laying birds. A mixture may be made **by measure** as follows:—

	Part
Curd	5
Maize meal	½
Standard laying mash No. 2	1
Finely chopped green food ..	1½

If maize meal is unobtainable, the formula may be changed to:—

	Part
Curd	4
Standard laying mash No. 2	3
Finely chopped green food ..	1½

This mixture may be fed in V troughs early in the morning and the birds allowed to eat as much as they will consume. Any left over may be left for them to return to later in the day, or alternatively a further feed of the mixture may be given immediately after lunch. The latter policy is a better one than leaving the mixture in the troughs all day. Late in the afternoon the birds should be given a grain feed at the rate of approximately 1oz. per bird and consisting of equal parts of wheat and maize or wheat and barley. The grain may be fed in the litter to ensure that the latter is well scratched over and to give additional exercise to the birds.

After March, when the amount of curd available falls off, it is necessary to increase the amount of standard laying mash used. At this stage standard mash No. 1, which contains meat meal, should replace the No. 2 mash recommended for September to March. Should no curd be available at any period, a small grain feed should be given early in the morning, a wet mash feed of laying mash No. 1 about 10 a.m., and a good grain feed at night. Winter egg production is assisted by supplying free meat meal in a hopper or tin. The birds will eat the meat meal readily to begin with, but will soon regulate their intake of this meal to what they require. Obviously, free meat meal is not necessary or desirable while any protein-rich curd is being fed to the birds.

From the experiment conducted at Ruakura over 2 years it was assessed that 12 to 15 cows gave sufficient separated milk to feed 100 laying birds. The following figures gave the relative amounts of curd, meals, and grain consumed by the two flocks of laying birds under test over the 2 years.

	1938-39	1939-40
Mean No. of birds	111	117
	lb.	lb.
Curd consumed ..	12,430	8,682
Meals consumed ..	12,430	7,195
Grains consumed .	3,828	2,797

Separated milk may be expected to supply 17 to 28 per cent. of its weight in dried curd and from 60 to 69 per cent. of its weight in whey. A loss of 5 to 16 per cent. will occur. In general terms separated milk produces about a quarter of its weight in curd and 2-thirds in whey. Once again it must be stressed that the curd should be well drained and dry to avoid a residue of whey, which will scour birds.

Small quantities of firm, dry curd may be fed in troughs to chickens, which relish curd. The curd assists in increasing the intake of protein for young chickens, the stage at which birds require a heavy protein diet.

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The above bulletins, part of a series of over 350 on all aspects of farming, are available post free from the nearest office of the Department of Agriculture, or from the Head Office of the Department, Box 2298, Wellington.

Feeding Fodder Beet to Cattle

By A. G. BRASH, Veterinarian,
Department of Agriculture,
Christchurch

FODDER beet has been used most successfully for some years in Denmark and for shorter periods in Great Britain and may be regarded as a useful food for cattle. In Denmark it has been used for feeding pigs also. It is only in recent years that it has been used in New Zealand; first it was used mainly as a pig feed, but it is now being used for feeding dairy cows, especially by town supply dairymen. It is generally regarded as a fairly safe feed for cattle and is extremely palatable to cattle of all ages. It is important, however, particularly when fodder beet is being introduced, to ensure that it is fed correctly. It is not dangerous if used properly, but it may be if the husbandry is at fault.

A RECENT case in the Christchurch district in which a number of cows showed digestive disturbance and one died shows that some care is needed in feeding it. The affected cows showed diarrhoea and depression and a drastic reduction in milk yield.

Overfeeding Must be Avoided

The main advantage of fodder beet over mangolds is that it can be fed out without being stored. It also has a higher dry matter content, 17 to 20 per cent. as against about 10 per cent. for mangolds. This last point is important, as it means that beet need not be fed in such large amounts as mangolds to provide the same feed value. In the herd mentioned it was being fed at about 50lb. per day per animal and on the day when most of the trouble occurred the cows accidentally ate some of the following day's ration, so that some probably consumed 60lb. or 70lb. of fodder beet. A more normal ration would be about 25lb. to 30lb.

Risks of Health Upsets

Danish authorities emphasise that the greatest care should be taken in feeding fodder beet with a dry matter content of more than 20 per cent. The higher the dry matter content is the greater the risks of digestive upsets or milk fever will be. It is most important that there should be no sudden change in the feeding routine. Experience overseas indicates that most of the dangers arise from errors in feeding practice and in particular from the sudden replacement on a fresh-weight basis of another root food by fodder beet.

There is no knowledge of the actual cause of the digestive disturbance, but it is not believed to be due to oxalate or nitrite poisoning. Analysis of the beet in the Christchurch case did not show toxic amounts of nitrate or any changes in the blood due to nitrite poisoning. Most of the trouble on post-mortem will be found in the rumen, where there is usually impaction, hemorrhage, and separation of the lining. Storing the beet will not cause any improvement; in fact, by increasing the dry matter content this procedure may increase the tendency to cause digestive upset. However, it is probably worth while to allow the beet to wilt for a day or two before it is fed; this will reduce any danger of oxalic acid poisoning from the tops.

Seventh International Grassland Congress

THE Seventh International Grassland Congress is to be held at Massey Agricultural College, Palmerston North, during the second week of November 1956.

It will last for a week and will be followed by post-conference tours in both the North and South Islands.

The Congress programme comprises 12 half-day sessions and 2 evening sessions. Each session will consist of a symposium of four papers dealing with a particular aspect of grassland problems and research.

Because the Congress is being held in New Zealand, the programme has been deliberately given a bias toward New Zealand grassland farming.

Many of the sessions will, however, be dealing with general subjects and an endeavour is being made to secure as authors of papers leading grassland research workers of the world.

Papers will be of a technical nature and will deal mainly with the results of research into problems and practices of grassland farming.

Particular emphasis is being laid on the pasture-animal complex, because in this some of the most important grassland problems are apparent.

Inquiries regarding the Congress should be addressed to the Organising Secretary, Seventh International Grassland Congress, P.O. Box 2298, Wellington.

The Choice of Chemical Weedkillers

RESEARCH work dealing with problems in weed control has been in progress at the Department of Agriculture's Invermay Research Station for the past three seasons. In this article J. N. Fitzgerald, Research Officer, Department of Agriculture, Taieri, discusses the control of weeds with particular reference to conditions in Otago and Southland and the tolerance of the more commonly grown crops to some of the newly introduced chemicals. Articles by L. J. Matthews, Weeds Research Officer, Department of Agriculture, Wellington, in "The New Zealand Journal of Agriculture" for April and May 1952 and reprinted in Bulletin No. 329 give details of the chemicals mentioned in this article. A list of the trade names and concentrations of the various commercial products is given in the table on page 53.

THE introduction of a large number of chemical weedkillers in recent years has made it difficult for the farmer to know which preparation is likely to be most suitable for his particular conditions.

If satisfactory results are to be secured, consideration must be given to the following points:—

1. The tolerance of the crop to the particular chemical and the stage of growth at which spraying can be regarded as reasonably safe.
2. The weed species which have to be controlled.
3. The stage of growth of the weeds at which spraying is found to be most effective.
4. The formula of the compound to be used.
5. The quantity of hormone weedkiller necessary per acre, expressed usually as pounds of acid equivalent per acre or abbreviated as "lb. a.e./ac."
6. The dilution of the compound for high-volume or low-volume spraying.

Each season at the Invermay Research Station a number of field trials are carried out to determine the tolerance of crops to different rates of application and the most suitable time to apply weedkillers. Complete weed control with no crop damage is the ideal, but generally partial weed control which will give suitable harvesting conditions with no yield losses has to be accepted. It is also important with weed control in pastures to determine when to spray and how much to apply. Clovers are only partially tolerant to the effects of weedkillers, and trials have been carried out to assess the damage suffered by clovers at different stages of growth.

Weeds in Crops

Wheat: Weedkillers most suitable for wheat spraying are the hormone herbicides, more especially the salts and esters of M.C.P. and 2,4-D. The water-based preparations (the salts of M.C.P. and 2,4-D) are less damaging than the oil-based ester preparations. The preparations which give the least crop damage are the water-based salts of M.C.P. These are recommended for use on spring-sown crops, which are more susceptible to damage from hormone herbicides. Autumn-sown crops appear to have more resistance and 2,4-D preparations are quite suitable. Normally 1lb. a.e./ac. is sufficient for the control of Californian thistle, fat-hen, wild turnip, etc. Trials at Invermay have shown that 2lb. a.e./ac. is the maximum that should be applied on a wheat crop. Heavily infested crops may require this dosage rate. Docks, cornbind, wireweed, and redshank are more resistant to the above preparations, but a recent product, the polyethylene glycol ester of 2,4-D, marketed as P.E.G. 2,4-D, has shown promise in dock control. As above, the maximum rate should be 2lb. a.e./ac.

Special care must be taken if the wheat has been undersown with clover. Seedling clovers are very sensitive to hormone herbicides and rates of even 1lb. a.e./ac. can cause heavy losses among the clover plants. If an undersown crop is heavily infested with an annual weed, it should be sprayed with no more than ½lb. a.e./ac. of salts of M.C.P. This will be sufficient for control of fat-hen and wild turnip and will check the growth of perennial weeds.

It is most important to choose the correct time to spray; serious yield losses can result from spraying at the wrong time. Generally, cereals **must not** be sprayed with hormone herbicides while they are seedlings, while tillering, or while the seed head is shooting or flowering. The safest time to spray is after the plant is fully tillered and before the shooting stage. In spring-sown crops this period is not very long. It may be limited to as little as 14 days, depending on the season and time of sowing.

Oats: Only the most selective material should be used for spring-sown cereals. Oats are more susceptible than wheat and barley and are usually spring sown, and so the water-based salts of M.C.P., at up to 2lb. a.e./ac., and the amine salt of 2,4-D, at up to 1lb. a.e./ac. are recommended. Spikelet formation occurs over a longer period in oats and the safest time to spray is after tillering. If clovers have been undersown with the oats, spraying, if necessary, should be at very light rates.

Barley: For weed control in barley, the salts of M.C.P. at 1lb. a.e./ac. applied after tillering are satisfactory. Research barley has proved to be tolerant to hormone herbicides, whereas Kenia is more susceptible.

In crop spraying a compromise must be reached between the stage of development of the crop and that of the weeds. For complete weed control, spraying later or earlier may be necessary, but it may be impossible owing to the growth stage of the crop. Spraying when the crop is ready checks the growth of weeds and often enables the crop to smother them and so present a clean field at harvest. Most important, the weed plants are prevented from seeding.

Linseed: Linseed may be sprayed when it is 4in. to 10in. high. Trials have shown that linseed is more susceptible to hormone damage when sprayed at a later stage. Linseed is classed as a semi-tolerant crop and the most selective material must be used. The salts of M.C.P. at ¾lb. a.e./ac. cause some temporary distortion with

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HEADING PHOTOGRAPH: Cross 7 wheat showing infestation with Californian thistle. The salts of M.C.P. are the most suitable weedkillers for wheat, as they do least damage to the crop.

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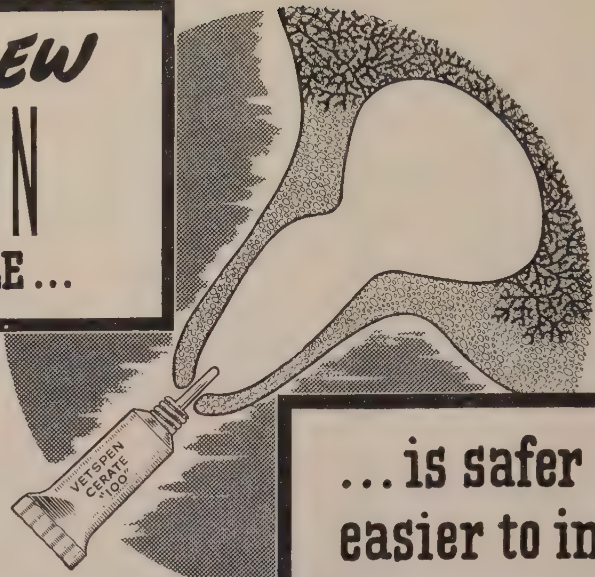

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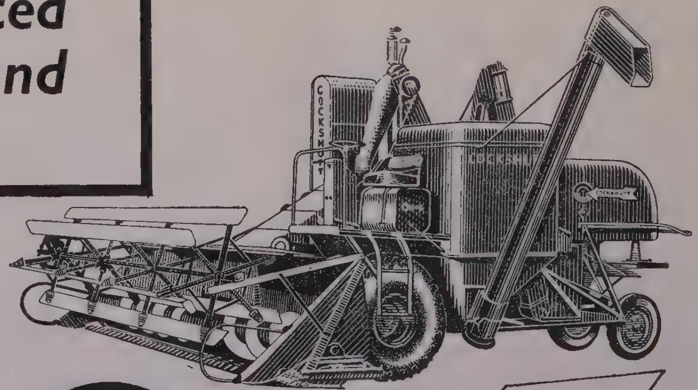

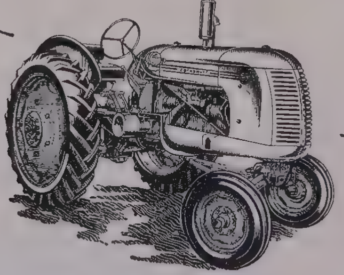

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M.C.P.	Sodium salt	"Yates Reliable M.C.P."	3.0	N.V.	Water	Annuals, herbaceous perennials, and crops
		"Agroxone 3"	3.0	N.V.	Water	
		"Phoxylene 30"	3.0	N.V.	Water	
		"Tuloxone 30"	3.0	N.V.	Water	
2,4-D	Sodium salt	"Yates Reliable Sodium Salt"	.75	N.V.	Water soluble powder	Annuals, herbaceous perennials, and crops
		"Phenoxone"	.75	N.V.		
		"Frenokone"	.75	N.V.		
		"SHWK"	.75	N.V.		
		"Economone"	.75	N.V.		
		"Stantox 90"	.75	N.V.		
	Amine salt	"Yates Reliable Amine Salt"	4.0	N.V.	Water	Annuals, herbaceous perennials, and resistant crops
		"Stantox 20"	2.0	N.V.	Water	
		"Stantox 64"	4.0	N.V.	Water	
		"Weedar 77"	4.8	N.V.	Water	
		"Ataweed"	1.25	N.V.	Water	
		"Ataweed Concentrate"	4.0	N.V.	Water	
	Ethyl ester	"Yates Reliable 2,4-D Concentrate"	3.6	V.	Oil	Annuals, semi-woody perennials, and perennials with waxy cuticles
		"Stantox P44"	4.0	V.	Oil	
		"Weedone 57V."	3.6	V.	Oil	
		"Ethone"	3.6	V.	Oil	
		"Ataweed"	3.6	V.	Oil	
		"D.40"	4.0	V.	Oil	
		"Winstone's 2,4-D"	4.0	V.	Oil	
		"Weedust 5"	.04	V.	Talc	
		"Weedust 15"	.12	V.	Talc	
		"Weedust Concentrate"	.25	V.	Talc	
	Butoxy ethanol ester	"Weedone 57 N.V."	3.6	N.V.	Oil	As for ethyl ester
	Polyethylene glycol ester	"Weedone PEG"	4.0	N.V.	Water	For difficult-to-kill semi-herbaceous perennials
2,4-D 2,4,5,-T	Butoxy ethanol esters	"Brushkiller 32"	1.6 .79	N.V.	Oil	Specifics 2,4-D and 2,4,5-T selective for appropriate weeds
2,4-D 2,4,5,-T	Butoxy ethanol esters	"New Improved Weedone"	.6 .3	N.V.	Oil	
2,4-D 2,4,5,-T	Ethyl ester Butyl ester	"Stantox T.45"	1.9 2.1	V.	Oil	
2,4,5,-T	Butyl ester	"Yates Reliable 2,4,5-T Concentrate"	3.6	V.	Oil	Brush or scrub plants, for example, woody perennials and scramblers like blackberries
		"Butoxone"	3.6	V.	Oil	
		"Stantox T.45S"	3.6	V.	Oil	
		"Summit 2,4,5-T"	3.6	V.	Oil	
		"Relionus 2,4,5-T"	3.6	V.	Oil	
		"Weedone Special V."	3.6	V.	Oil	
		"Winstone's 2,4,5-T"	3.6	V.	Oil	
	Butoxy ethanol ester	"Weedone Special N.V."	3.6	N.V.	Oil	As for butyl esters

* Water = water based; oil = oil based; talc = in dust form with a talc filler.

no yield loss; higher applications (1lb. and more per acre) may seriously reduce yields.

Potatoes: Weed control in potatoes is not usually a problem, as inter-row cultivation and moulding up deal with most weeds. However, a heavy infestation of Californian thistle or fat-hen is not easily controlled by these methods and spraying is a useful method of reducing the spread of these weeds. As with linseed the maximum rate applied should be ¾lb. to 1lb. a.e./ac. of the salts of M.C.P. or 2,4-D; 2,4-D causes more leaf distortion than M.C.P. and should be used at no more than ¾lb. a.e./ac. Spraying can be carried out any time until 2 to 3 weeks before the plants are due to begin flowering. In trials at Invermay rates higher than 1lb. a.e./ac. have not affected some varieties, but more trials will have to be carried out to determine the extent of variation in reaction among potato varieties.

Sometimes weed growth after the haulms have wilted makes digging of the crop difficult, and it is often useful to spray at that time to give a clean crop and to prevent the spread of weed seeds. Salts or esters of 2,4-D and M.C.P. can be applied at 2lb. a.e./ac. once the haulms have begun to wilt. In crops with heavy top growth, defoliant sprays such as arsenic compounds or sodium chlorate preparations can be applied to give a complete burn off of haulms and make digging less difficult.

Peas: Peas are sprayed to control annual weeds, such as wild turnip and fat-hen, and for Californian thistle. D.N.B.P. compounds are the most reliable for annual weed control in peas, though they are ineffective against Californian thistle. D.N.B.P. compounds act as contact herbicides and their effect is immediate and short-lived. Also their effectiveness depends primarily on the temperature at the time of spraying; 3 to 4 pints per acre of 20 per cent. D.N.B.P. gives good control of annual weeds, and the optimum temperature for application is between 60 and 70 degrees F. If it is applied at temperatures below this, results may be somewhat disappointing, and with temperatures higher than this, crop damage may result. Peas are liable to be damaged by more than light applications of hormone herbicides, but garden peas may be sprayed with ½lb. of the salts of M.C.P. or ⅜lb. of amine salt of 2,4-D per acre. Californian thistle in peas can be controlled only by hormone spraying. The above rates, however, will not give a kill of thistle, but will check its growth and spread. Peas can be sprayed when they are 4in. to 5in. high, and until 2 to 3 weeks before flowering. Partridge peas should not be sprayed with a hormone.

Lucerne: Present available preparations of hormone herbicides with the exception of water-based preparations of M.C.P. at lower rates of application cannot be used on lucerne, but D.N.B.P. compounds can be used for the control of annual weeds in newly sown stands. Young lucerne may be sprayed with 3 to 4 pints of D.N.B.P. per acre when they have 5 or 6 true leaves. Mature lucerne is often infested with ryegrass and other grasses which seriously curtail the life of the stand. Invermay trials have shown that seedling ryegrass can be controlled by the use of T.C.A. and I.P.C. These chemicals have the opposite effect to the hormone herbicides in that they kill grasses and not broad-leaved plants. Also, they are root-killers and must be washed into the soil to gain their full effect. Twenty pounds of T.C.A. per acre applied in July on mature lucerne gave good control of invading grasses with only a 10 to 15 per cent. drop in yield in the first cut in the following season. Where grass infestation is likely to be serious pre-emergence spraying (after the seed is sown) of T.C.A. or I.P.C. will give the crop a chance to establish without competition. Pre-emergence spraying of I.P.C. at 4lb. per acre in

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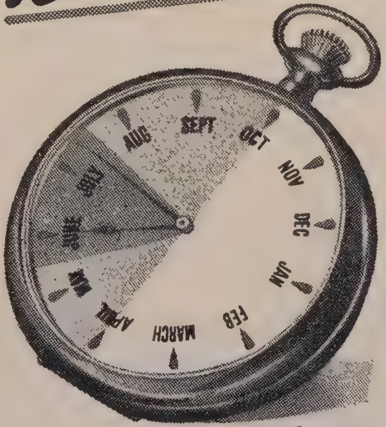

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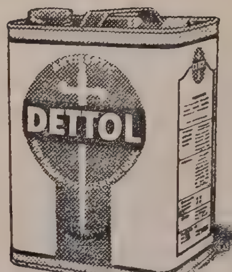

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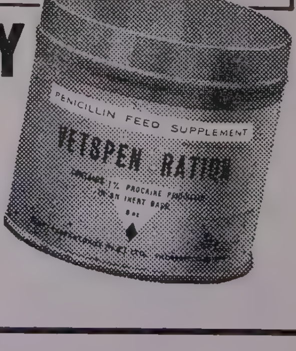


one trial gave excellent control of ryegrass, *Poa annua*, and chickweed. Spraying with T.C.A. after grubbing in winter on mature stands may possibly give better control in the following spring.

Newly sown lucerne which has become infested with spurrey and other weeds. D.N.B.P. compounds are suitable for weed control in this crop.

Pasture Spraying

Grass seed crops: Grasses, like the cereals, are resistant to hormone herbicides, which may be applied at the usual rates for the control of Californian thistle, docks, fat-hen, etc. Care must be taken in first-year pastures that the grasses are fully tillered before spraying and that spraying is not done at the bud stage of flower head formation. Like cereals they must not be sprayed at this stage or the yield of seed may be seriously reduced. If the pasture is intended for grazing in the following years, dosage rates must be reduced to avoid damage to clovers.

Pastures: Spraying of pastures for the control of weeds such as Californian, Scotch, and variegated thistles, ragwort, docks, etc., has been widely practised in recent years. Control of these weeds can be obtained by using 1lb. to 2lb. a.e./ac. of the salts and esters of M.C.P. and 2,4-D. Docks can be controlled more effectively by the polyethylene glycol ester of 2,4-D (P.E.G. 2,4-D). The control of Californian thistle, docks, and ragwort usually requires two applications in successive years, and often three if the infestation is heavy. All plants are sensitive to the effects of hormone herbicides when they are approaching the flower bud stage, and for perennials which are hard to kill, such as Californian thistle and docks, this is the most effective time of application.

Grasses are resistant to the effects of hormone herbicides, but special care must be taken, as clovers are only partially tolerant. Weed control in pastures will be hardly economic if the clover content of the pasture is seriously reduced. Invermay trials have shown that seedling clovers are very sensitive to applications of 1lb. a.e./ac. of M.C.P. or 2,4-D. Mature clovers are more tolerant, especially to M.C.P. Oil-based esters are more severe than the water-based salts. Montgomery and broad red clovers show similar tolerance, and white clover is less susceptible than these, even if it has made heavy foliage growth. Subterranean clover proved to be the most tolerant species when mature, this probably being due to the hairy nature of the leaf. The maximum application on first and second year pastures should be 1lb. a.e./ac. of salts of M.C.P. applied when the pasture has been eaten down and not when the clovers are flowering. This will give some clover distortion but good recovery will follow. Applications of 2lb. a.e./ac. of 2,4-D or M.C.P. should be applied to old pastures only when the clovers are partly protected by vigorous grass growth. Preparations of 2,4,5-T for brush weed control have proved to be fatal to clovers, even when applied at 1lb. a.e./ac.

Preparations of 2,4,5-T for brush weed control have proved fatal to clovers, even when applied at 1lb. a.e./ac. The effect of 2,4,5-T on white clover is shown above. The right hand side of the photograph shows untreated white clover; the area on the left, nearer to the camera, has been treated with 1lb. a.e./ac.; and the area beyond that has been treated with 3lb. a.e./ac. The application was made at an early growth stage and the photograph was taken some considerable time later.

Care must be taken when spraying 2,4,5-T near a pasture or crop.

Barley grass in old pastures can be reduced by the use of T.C.A. applied at rates which do not affect the perennial pasture grasses but kill the seedlings of the annual barley grass. Up to 20lb. of T.C.A. per acre will give a good kill of seedlings if applied in the autumn or winter. As barley grass germinates in autumn and spring, applications then of 20lb. per acre may give more efficient control. This would be useful where barley grass is spreading from a hedge or sheep yards. Mature clovers can tolerate up to 20lb. of T.C.A. with only a temporary growth check.

Acid Equivalent

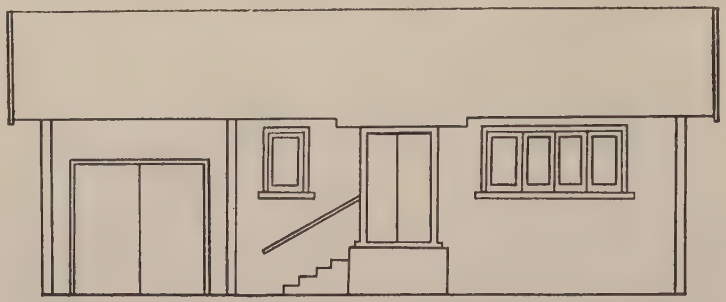
All hormone herbicides are labelled as having so many pounds of acid equivalent per gallon. This is the most satisfactory and safest method of calculating dosage rates. Therefore, if a preparation contains 3lb. a.e./gallon, 1 gallon will spray 3 acres at a rate of 1lb. a.e./ac. or 1½ acres at 2lb. a.e./ac. Similarly 4lb. a.e./gallon will spray 4 acres at 1lb. a.e./ac. or 2 acres at 2lb. a.e./ac. Care must be taken when mixing the preparations, as an overdose can have serious consequences.

Nozzle Size

Most low-volume spray booms have the 32M nozzle attached. This gives a fine spray of small droplet size which is most efficient for crop spraying. Larger size nozzles such as 49M and 52M are used where a coarser droplet size is wanted. This reduces the danger of crop damage in the spraying of annual weeds in potatoes and peas.

Honey House Construction and Layout of Plant

By L. H. JOHNSON, Apiary Instructor,
Department of Agriculture,
Palmerston North



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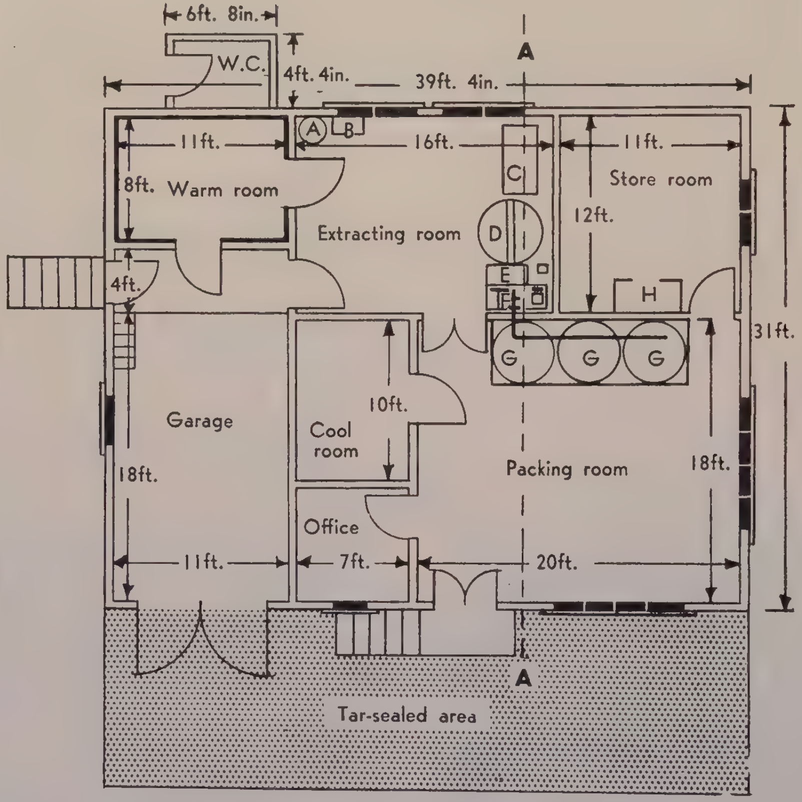
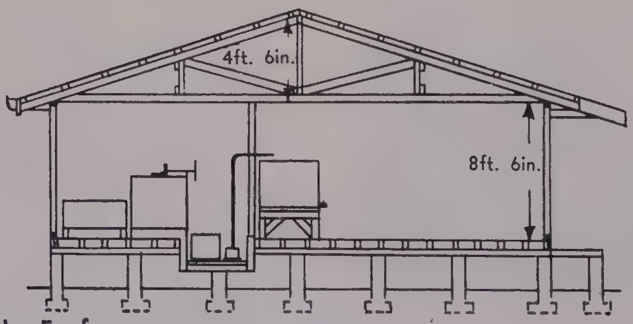


Plan



Plan No. 5 of Honey House

Section AA

A—Electric hot water cylinder. B—Washhand basin. C—Cappings melter. D—Extractor. E—Small honey tank. F—Honey pump, pulleys, and motor. G—Honey tanks. H—Hats and coats space.

TWO plans of buildings and outhouses based on the requirements of a 1-man establishment of 400 colonies of bees are featured in this article on honey house construction and layout of plant. It is the third of a series, the previous two having appeared in the May and June issues of the "Journal". The houses may cost more to build than those described previously, because of the greater floor space, but they should be better to work in.

SEVERAL honey producing districts in the North and South Islands give a return of only 2 tons of honey per 100 hives per annum, but in others (fortunately the greater area) the return is nearer 4 tons annually. This must be one of the determining factors governing capital investment.

The young man who raises a loan for buildings at the beginning of his beekeeping career should look to the future with confidence and build as large as he can afford. It is also good business for the established beekeeper whose apiary buildings are obsolete to plough back some of the profits made in prosperous seasons by erecting good buildings which will be an enduring asset and a landmark in personal achievement. The design of buildings and layout of plant are major considerations. A detailed building specification should not be necessary, as it is assumed that a building will be erected according to recognised building practice. Plans of houses on economy lines have already been given in the earlier articles in this series.

Plan No. 5

Plan No. 5 is for a building on a level section.

Foundation

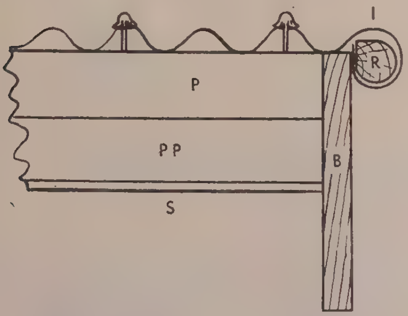
Concrete piles with 12in. x 12in. bases should be satisfactory on most building sites where the subsoil is consolidated. If the building site is peat land or a section that has been raised by filling in a depression, continuous foundation walls with reinforcing should be allowed for. The concrete should extend approximately 1ft. above the ground and the rest of the foundation should be built up with dwarf walls of heart timber to carry the sleeper plates.

Because of the heavy floor loading the piles should be spaced according to the width of the building, provided they do not exceed 5ft. centres and 4ft. centres in the rows. Heart timber should be used for the usual 4in. x 3in.

sleeper plates, 5in. x 2in. joists, and 6in. x 1in. tongued and grooved flooring. Wall framing and roof are of 4in. x 2in. timber with 3in. x 2in. purlins. Outside walls may be weatherboarded either horizontally or vertically. Roof framing should be covered with wire netting, felt, and corrugated iron or aluminium. To prevent the all too common leaks under lead-headed nails, nail holes in the iron should be punched through from the reverse side to that exposed.

Iron Roll over Barge Board

Cover boards to fix over the edge of the iron and the barge board cannot be recommended for a permanent job. A much better job may be done by rolling the iron around a strip of timber 1⅜in. x 1⅜in. by the length of the barge board. First hang the sheets of iron over the face of the barge board and fix them with small nails, allowing the edge of the iron to project ⅜in. above the top of the barge board. The 1⅜in. x 1⅜in. strip of timber with three corners rounded off is fixed ⅜in. above the barge board. The sheet is then pulled up, rolled around the strip, and fixed to the purlins.



Details of iron roll over barge board. B—Barge board. I—Corrugated iron. P—Purlin. PP—Packing piece. R—Roll strip 1⅜in. x 1⅜in. S—Soffit.

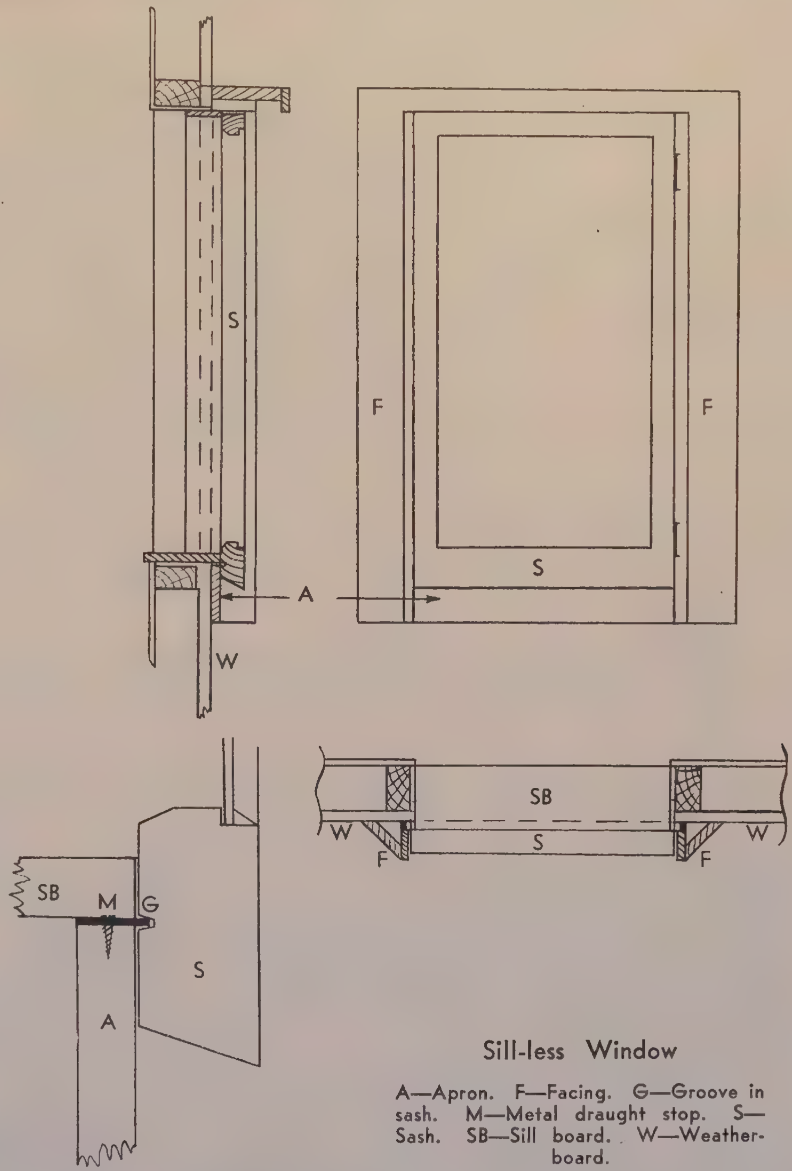
Windows

In the past insufficient window space has been the rule rather than the exception in honey houses. Casement windows with sashes each 3ft. 6in. x 22in. will admit daylight to all the rooms except the garage and extracting room. Bees brought in with combs of honey can be a nuisance in the extracting room. Two pairs of opening glass louvres not only admit sufficient light but are a simple means of clearing bees that cluster on the glass, as quick opening of the louvres lets them slide outside. If a hive is placed nearby, the bees will collect in it.

A fixed sash 2ft. 6in. x 22in. should give the minimum of light for the garage.

Sill-less Window

The orthodox type of window has one fundamental weakness: it is not possible to make a permanently waterproof joint between the sill and the jambs. A galvanised iron tray must be placed under the sill to prevent water seeping into the wall. Another undesirable feature is that clearance between the sash and the sill is such that water is held by capillary attraction and so causes good conditions for rot fungi to attack the corner of the sash, the sill, and the jamb. The design shown at right above has been developed by the author after several years' experience at making windows, fixing them in buildings, and repairing old ones. A 3-light window of this design has been in use for some time and is satisfactory. The diagram should be self-explanatory. It will be seen that the bottom rail of the sash is designed to fit against the face of the apron piece, which is outside the weatherboards so that all water will drip outside. Also the capping on the window head, which must be flashed, is designed with a space so that water will drop clear and not run in over the top of the sash. This window should be suitable not only for a honey house, but should be an improvement on the ordinary casement window for a dwelling.



Sill-less Window

A—Apron. F—Facing. G—Groove in sash. M—Metal draught stop. S—Sash. SB—Sill board. W—Weatherboard.

Inside walls should be lined with hardboard, fibrous plaster, or plaster centre wallboard. Asbestos cement sheets or wood pulp softboard may be used provided it is backed with sawn timber and again protected on the face side with 3in. x 1in. battens fixed horizontally 1ft. apart to the studs. This protection should be provided up to 4ft. from the floor. It is also necessary to fix architraves to the windows and doors and a skirting to the walls. Ceilings may be lined with wood pulp softboard.

Paint

On no account should a cheap, flat water paint be used. Only an oil or plastic paint which is water resisting and washable should be considered. Window sashes, doors, honey tank stands, extractor stands, or any other exposed woodwork should be painted with durable paint. The reason for this is that any splashes of honey on raw wood will penetrate the wood cells and harbour yeasts, which will make the timber very unsightly and impart an odour of fermentation.

Floors

Though honey should not be spilt on the floor and tramped about, this

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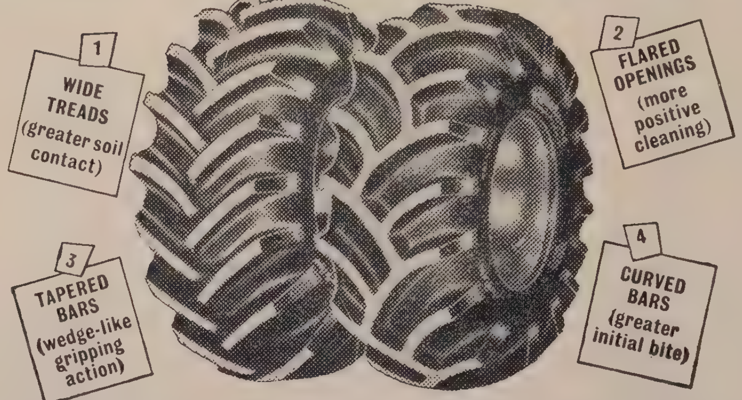
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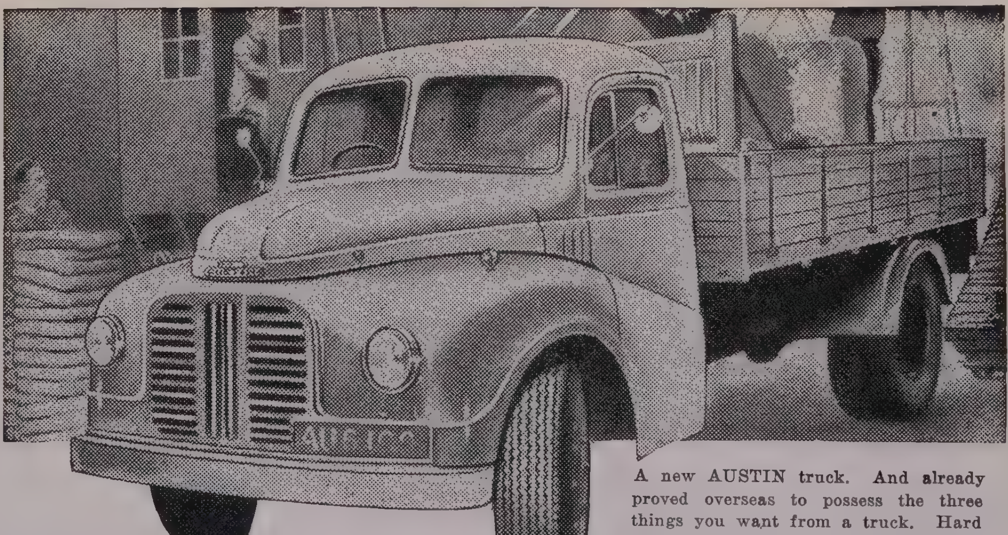

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is sometimes unavoidable in the extracting room. It is recommended that the floor of the extracting room be covered with inlaid linoleum, which should be neatly fitted and glued down with linoleum cement. Much time will be then saved when floors are being cleaned up at the end of each day. All the equipment should be movable so that the floors can be cleaned thoroughly. Often fermentation in honey can be traced to unhygienic conditions in the honey house.

Warming Room

A warming room is a great aid to extracting, especially in late autumn. Many materials may be used for insulating, but a simple method is to double line the walls and ceiling with wood pulp softboard. Under the floor may be done in the same manner. The doors also should be double lined with softboard and be neat fitting. Two doors should be provided so that unextracted honey may be loaded in from the motor truck and left to warm up. Later it may be moved through the door into the extracting room as required.

Honey Extracting Room

Access to the honey extracting room may be through the garage or the packing room. This arrangement does not allow bees from outside to enter when a door is opened. Supers with combs of honey may be placed handy to the cappings melter and empties from the extractor near the door for returning to the motor truck. A section of floor should be recessed to take a small tank and the honey pump. The top of the tank should be 2in. or 3in. above the floor. If the floor boards in this recessed portion are left loose, they may be removed for cleaning. A washhand basin and electrically heated water should also be provided.

Honey Packing Room

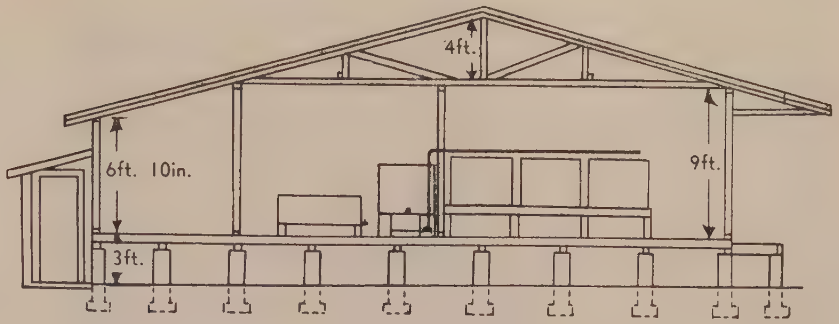
The main factors which have been considered in the design of the packing room are:—

Position: It is preferable to have the room at the front of the building rather than at the rear.

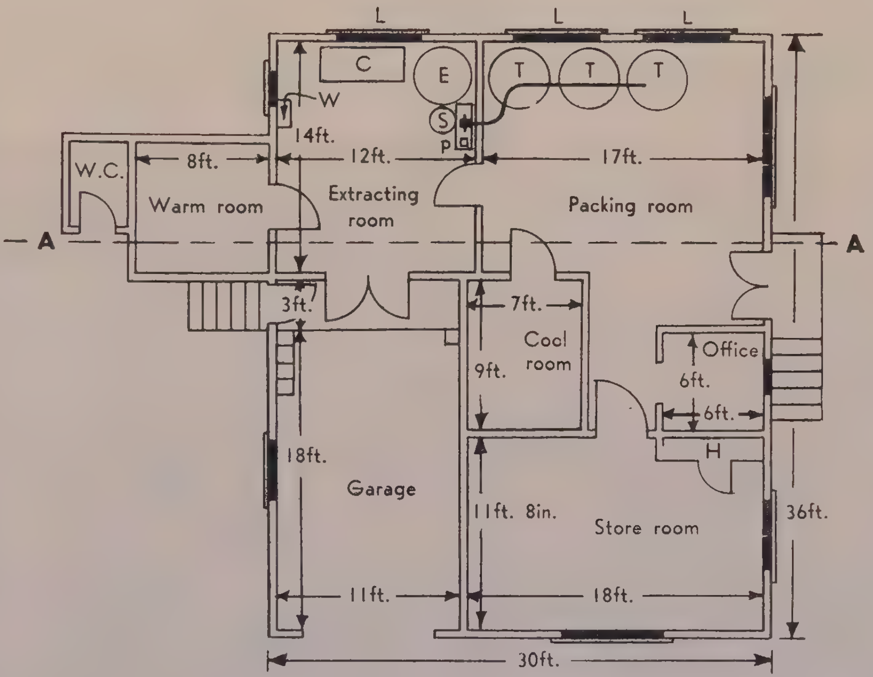
Floor space: It should be the largest room in the building.

Layout: With honey tanks arranged on the wall adjacent to the extracting room, honey is pumped the minimum distance. The honey level in the tanks can be seen from the

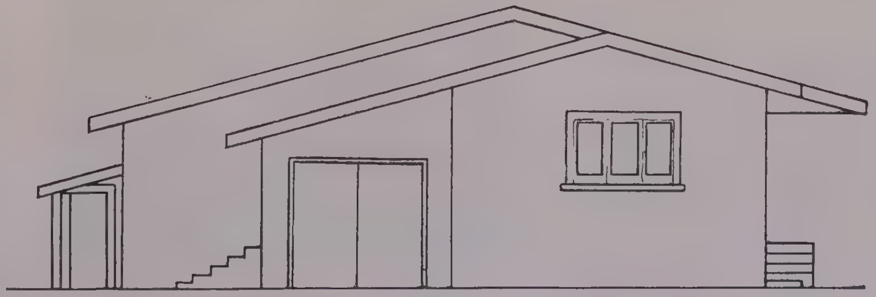
Plan No. 6 of Honey House



Section AA



Plan



Front Elevation

C—Cappings melter. E—Honey extractor. H—Hats and coats space. L—Glass louvres. P—Pumps and motor. S—Small tank. T—Tanks. W—Washhand basin.

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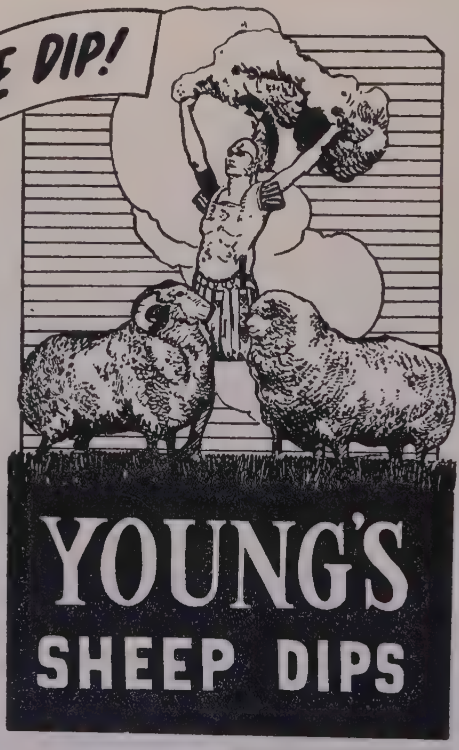

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door of the extracting room. A separate entrance to this room is an advantage.

Cool Room

A cool room is necessary only when honey is to be packed while the weather is still warm in late summer. A room temperature of 55 degrees F. will complete the process of securing a fine-grained honey. The cool room is designed to be located in the centre of the building to escape the effects of the sun's rays. The insulation of the room and the refrigeration unit will be the subject of a special article.

Store Room

The store room will accommodate empty honey containers and other unused equipment so that the packing room can be kept tidy and hygienic. A wardrobe for hats and coats could also be built in the room.

Frontage

A strip across the front of the building should be tar-sealed or concreted to prevent dust. The way to the main entrance is up steps to a platform. Honey for market may be loaded on to a truck from here. The double doors are for easier passage with a floor trolley, and also allow for moving in large tanks, a point which should not be overlooked.

Toilets

If persons are to be employed on the premises, toilets are essential. Such accommodation should be separate for each sex, should be convenient to the place of work, should be adequately lighted and ventilated, and should at all times be kept clean and in good repair.

Lighting

During extracting beekeepers often work until late at night. Electric lights should be installed in each room, including the warming and cool rooms. Power points should be placed in the extracting room near the cappings melter or the honey pump and at least one in the packing room.

Plan No. 6

Plan No. 6, like No. 5, is suitable for a building on a level section, but a site having a rise of 1ft. in 12ft. would be satisfactory provided the garage entrance was at the lower level. An excavation would then have to be made for the garage, but there would be a considerable saving in concrete for the foundation of the building.

A wax rendering shed.

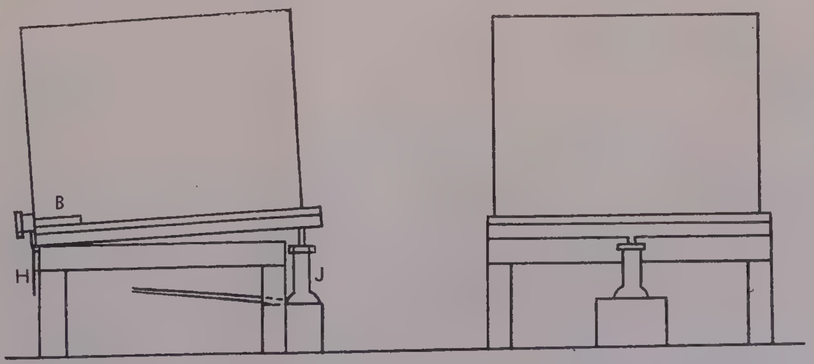
The roof of the garage and warming room is carried over at the same rake, thus avoiding unnecessary height. As the materials to be used and the construction in the main are similar to those in Plan No. 5, only items not seen clearly on the plan need be specified. There is a narrow stair in the garage for the truck driver to climb on to the stage. The honey extractor must be set on a stand for honey to run from it into a small tank and then be pumped to the main tanks.

A length of 1in. plastic pipe from the pump to the tanks makes an excellent pipeline.

Honey Tank Stands

A tank stand with a double deck that can be raised at the back is needed for draining honey out through the gate. The front is hinged and also has blocks fixed on top of the deck to prevent the tank from sliding forward. A small hydraulic jack set on a block of timber at the rear of the tank stand can be operated with a long handle from the front.

The same tank could also be raised with a block and tackle.



Left—Side view of honey tank stand. B—Blocks to prevent tank from sliding forward. H—Hinge. J—Hydraulic jack. Right—Rear view of stand for circular honey tank.

Outbuildings

The three outbuildings shown in the diagrams on pages 63 and 64 should be detached from the honey house for the following reasons:—

It reduces the fire hazard.

It is more economical to build the units separately.

There is little trouble with dust.

Bee Comb Storage Shed

The bee comb storage shed should be cool, dark, and vermin proof and should also have louvres which may be closed tightly or opened for abundant ventilation as required. It is just a shell of a building with the minimum of framing timber with outside sheathing of second-class material. If a room for bee combs is attached to the honey house, the same standard of building material would be required throughout and this would add to the cost of the storage space.

The foundation walls and floor must be of concrete and the framework of 4in. x 2in. timber with 3in. x 2in. purlins and 6in. x 1in. collar ties and roof struts. If the outside sheathing is to be asbestos cement sheets, studs should be set at 2ft. centres. Sawn timber fixed vertically with 3in. x 1in. battens over the joints is more durable than horizontal weatherboards. Studs may be set at 3ft. centres with two rows of dwangs for upright weatherboarding. To avoid drips from condensation on the under side of the corrugated iron roof, wire netting and building paper should be placed over the purlins and the iron then fixed in the usual way.

Control of ventilation: Yeasts can cause fermentation in honey in stored

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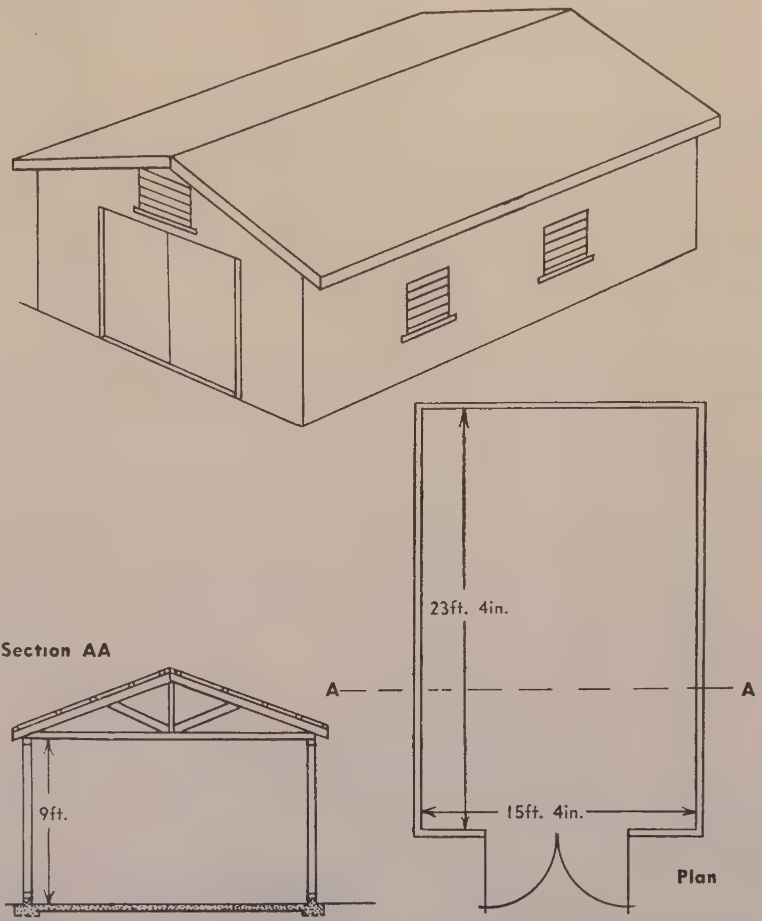
Four wooden louvres each 2ft. 6in. x 3ft. may be fixed to the side walls and two in the gables. Wire gauze should be fixed to the inside of the louvres to keep out vermin.

Should it be necessary to fumigate all the combs at once, this may be done without endangering human life by covering the louvres on the outside with plywood or hardboard and then removing it after the operation is completed.

Pollen dust will accumulate on the floor, but as this is a separate building, the honey house will not be contaminated by it. Creosote should not be used on this building, as comb storage buildings which have been creosoted inside and out give off fumes which penetrate the bee combs. Honey extracted from combs so stored will have a definite and characteristic sharp, burning taste. The flavour will persist for years if the combs are stored in the same condition.

Bee Comb Storage Shed

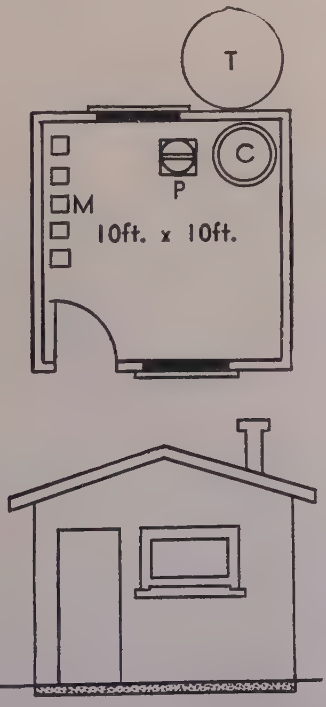


Wax Rendering Shed

There is also a fire hazard when bee combs are being boiled up over a fire. This is the main reason why the wax rendering shed should be a detached building. Pressing wax is not clean work and the honey house should not be defiled.

A wooden framed shed with a concrete floor 10ft. x 10ft. is not too small. The warm temperature so necessary for the job can be maintained more easily in a confined space. Timber or asbestos cement sheets form the walls and corrugated galvanised iron the roof. A gable or hip roof is always preferable to a lean-to type even for a small building.

Wax Rendering Shed



C—Copper boiler. M—Moulds of wax. P—Wax press. T—Water tank.

Two small windows, which may hinge at the top, and a ledge door will complete the shed. A tank to store rain-water is also necessary. Drainage should be given some attention.

Minimum plant required: A large pumice copper boiler of a stock pattern is needed for boiling up old combs. For drawing off hot water a short length of 1in. copper pipe with a tap at one end should be put through the pumice casing into the copper near the bottom and be brazed in. An oblong copper tank bricked in with a firebox and chimney would be more useful than the round boiler for boiling frames, hive bodies, or capping melter baskets.

The press on the left side of the boiler would seem to be the most convenient arrangement for most men. There is room for supers of old combs on the floor behind the operator. Liquid wax may be run into tapered moulds and stood on the floor out of the way to harden. The copper boiler will also supply hot water for washing other honey house appliances.

Workshop and Woodworking Machines

It would be futile to tar-seal the driveway to control dust in compliance with the health regulations if woodworking machinery is to be used in the honey house. This is a sound reason for erecting a separate workshop building.

No beekeeper's establishment is complete without a workshop for woodwork and to a less extent for metal work. The plan on page 64 will show what is required. An unlined shed 18ft. x 12ft. inside is not too large. Concrete foundation walls at least 9in. above the ground are necessary. A concrete floor is desirable, but not essential. An earth floor should be quite good for this shed if 6in. of soil were added, screeded off level, and rolled until hard. An earth floor is not tiring to work on as is concrete. In time the floor would be well covered with sawdust.

Arrangement of shop and machines: On the left side a rack to take timber is built the length of the building and from floor to ceiling joists. A door the height of the stud (8ft.) and the width of the rack (20in.), is provided for taking timber in and out from the end (see front view of workshop on page 64. The front and back doors (see plan on page 64) can be opened to permit long lengths of timber to be ripped with the circular saw.

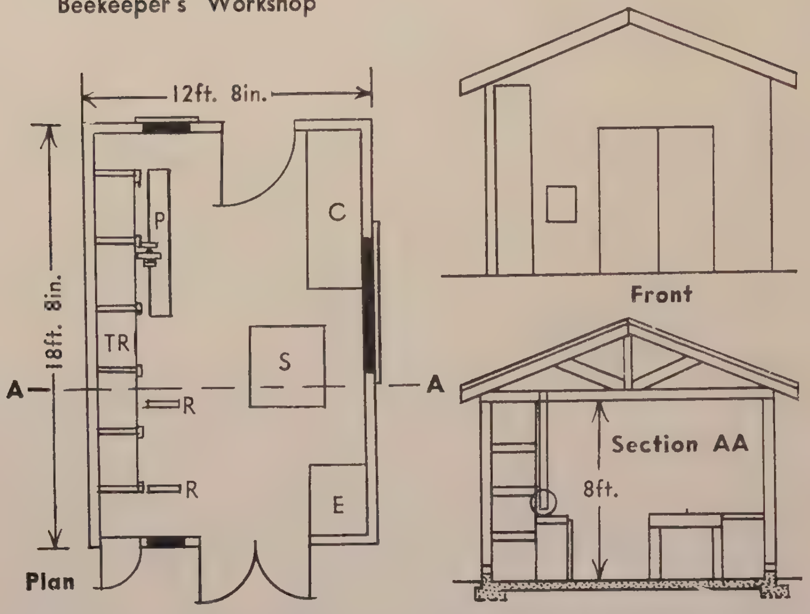
A pendulum saw will be very useful for cross-cutting long lengths of timber. Boards may be run through a small door and over rollers to a stop on the bench past the saw and cut accurately to any length. Though the pendulum saw has only one use, it is always ready for cutting without having to be set up. Possibly the most commonly used saw bench is home-made. Briefly, this is a wooden frame with a rise and fall table and a ¾in. diameter saw spindle with ball bearings. This unit is powered by a 2 h.p. electric motor with a V-belt drive. A very useful all-purpose saw bench is a cradle saw having a rise and fall table.

Unless it were possible to purchase a second-hand panel planer for a very low price, there would be insufficient work to justify the outlay for a new machine. A narrow surface planer would be very useful for dressing edges and rabbeting.

A carpenter's bench with a vice, numerous shelves on the wall, and pegs to hang tools on will be necessary. At the other end of the shop a smaller bench can be set up for metal work. A good vice and a small anvil are useful.

Several buildings will require more land, but if any of them is destroyed by fire, the beekeeper does not lose all his equipment as he would in a single building containing all the units.

Beekeeper's Workshop



C—Carpenter's bench. E—Engineer's bench. P—Pendulum saw. R—Rollers. S—Circular saw bench. TR—Timber rack.

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11 August—"Weed Control", by G. L. Banfield, Instructor in Agriculture, Department of Agriculture, Thames.

18 August—"Stock Troubles in Spring", by G. V. Wallace, Veterinarian, Department of Agriculture, Auckland.

25 August—Young Farmers' Club talk, by F. C. Roberts, secretary, Auckland council, Federation of Young Farmers' Clubs, Hamilton.

1XH Hamilton, 8 p.m.

5 August—"Good Shepherding", by G. R. Mackintosh, Livestock Instructor, Department of Agriculture, Hamilton.

12 August—"Current Farming Problems", by panel of speakers.

19 August—"Marketing of Beef", by H. A. Wagstaff, Federated Farmers, Hamilton.

26 August—"Sterilisation of Milking Shed Equipment", by L. E. Downs, Special Inspector, Department of Agriculture, Hamilton.

1YZ Rotorua, 7.15 p.m.

5 August—Y.F.C. talk, by Eastern Bay of Plenty district committee.

19 August—"Seasonal Work in the Apiary", by R. Goddard, Apiary Instructor, Department of Agriculture, Tauranga.

2YZ Napier, 7.10 p.m.

3 August—"Pre-harvest Management of Small Seed Crops", by F. H. Collin, Fields Instructor, Department of Agriculture, Hastings.

31 August—"Grass-grub and its Control", by A. J. Coughlan, Fields Instructor, Department of Agriculture, Hastings.

2XA Wanganui, 8 p.m.

5 August—Countrywoman session, by Mary MacDonald.

12 August—"Radio Vet.", by S. Jamieson, Veterinarian, Department of Agriculture, Wanganui.

26 August—"Synthetic Soil Conditioners", by G. R. Moss, Fields Instructor, Department of Agriculture, Wanganui.

2ZA Palmerston North, 12.30 p.m.

2 August—"Calves Need Attention", by A. W. Hart, Veterinarian, Department of Agriculture, Palmerston North.

9 August—"Some Aspects of Mole Drainage", by E. W. S. Wilson, Farm Drainage Officer, Department of Agriculture, Palmerston North.

16 August—"Hygiene in the Milking Shed", by M. J. McFetridge, Special Inspector, Department of Agriculture, Palmerston North.

23 August—"Planning the Vegetable Garden".

30 August—Y.F.C. session, by I. G. Tabor.

4YA Dunedin, 9.15 p.m.

4 August—"Fertiliser Trials in North Otago", by W. R. Lobb, Instructor in Agriculture, Department of Agriculture, Oamaru.

11 August—"High Country Pasture Investigations", by J. M. Hercus, Instructor in Agriculture, Department of Agriculture, Alexandra.

18 August—"High Country Pastures", discussion between runholder and J. M. Hercus, Instructor in Agriculture, Department of Agriculture, Alexandra.

25 August—"Major Pests and Diseases in Orchards", by D. W. Wilson, Horticultural Instructor, Department of Agriculture, Roxburgh.

4YZ Invercargill, 7 p.m.

3 August—"The Y.F.C. in Eastern Southland", by L. Reid, Fields Instructor, Department of Agriculture, Gore.

24 August—"Topdressing Tussock Country", by T. Sewell, Instructor in Agriculture, Department of Agriculture, Gore.

31 August—"Chemical Control of Weeds", by W. Faithful, Fields Instructor, Department of Agriculture, Invercargill.

Regular Sessions

1XH Hamilton, Mondays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (stock sale review).

1XN Whangarei, Mondays at 8.5 p.m., Wednesdays at 8.1 p.m. (Northland stock market report), Fridays at 8.1 p.m.

1YA Auckland, Mondays at 7 p.m. (Auckland stock market report), Tuesdays at 12.35 p.m., Wednesdays at 7 p.m., Thursdays at 12.33 p.m.

1YD Auckland, Thursdays at 7.30 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock market review), Tuesdays at 7 p.m. (Hamilton stock market report), Wednesdays at 7.15 p.m. (Pig Council talk on fourth Wednesday of every other month), Thursdays at 12.33 p.m. and 7.15 p.m. (fortnightly).

2XA Wanganui, Wednesdays at 8 p.m., Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m., Fridays at 8.2 p.m. (Gisborne stock market report).

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8.1 p.m.

2YA Wellington, Mondays at 7.15 p.m., Thursdays at 12.33 p.m., Fridays at 7 p.m.

2YZ Napier, Tuesdays at 12.12 p.m. (Hawkes Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m., Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m.

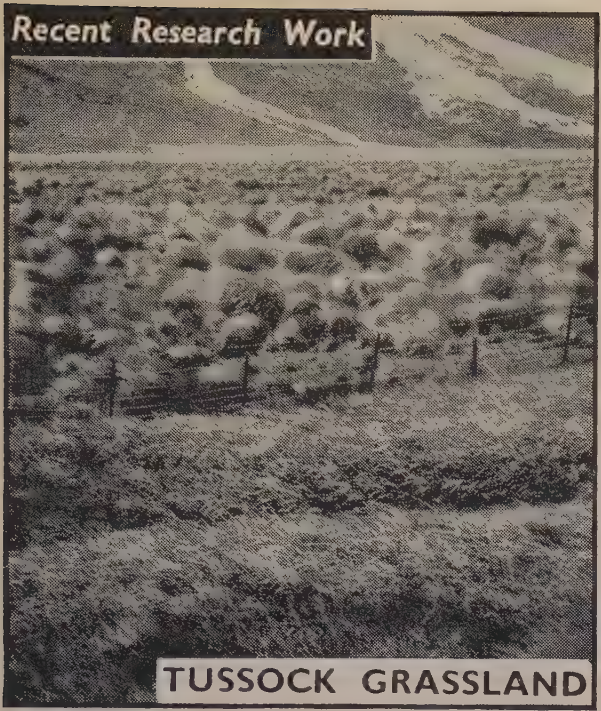
3XC Timaru, Mondays at 8 p.m., Tuesdays (fortnightly) at 8 p.m., Wednesdays at 8.5 p.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m., Thursdays at 12.33 p.m. and 7.15 p.m.

3YZ Greymouth, Thursdays at 12.33 p.m.

4YA Dunedin, Wednesdays at 7.20 p.m. and 9.15 p.m., Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m., Tuesdays at 7 p.m.



Recent Research Work

TUSSOCK GRASSLAND

OUTSTANDING results have been secured through oversowing clover seed and fertiliser on tussock and depleted country, but improvement of the native species is with few exceptions slow. This has led to trials with introduced grass species, some of which, such as tall oat grass, cocksfoot, and *Bromus inermis* are quite promising. With the development of aerial topdressing, however, the future of large areas of tussock country is much brighter than was previously considered possible. At present the Extension Division of the Department of Agriculture has 47 trials in progress on this problem land.

GRASSES AND CLOVERS

THE most promising grasses so far used are cocksfoot, tall oat grass, *Bromus inermis, Agropyron intermedium, Elymus glaucus, Eragrostis curvula,* and tall fescue. Further work is being done on the production of seed of these species. Of the clovers found to be useful the most outstanding are alsike, white clover (both pedigree white and Kentish wild white), Montgomery and broad red clovers, and zig-zag clover. Lucerne also has been found useful. Zig-zag clover has somewhat limited use because of its failure to set seed except in very small amounts. Of other species found to be valuable on this land yarrow, sheep's burnet, and to a less extent chicory show a good deal of promise. Field testing of these species is continuing with testing of other grasses and clovers of North American, South African, and Russian origin. Native species, for example, *Agropyron scabrum* and *Dichelachne crinata,* also are being tested.

METHODS OF SOWING

Several trials have been laid down to investigate the best method of oversowing seed and comparisons have been made of broadcasting and drilling seed with different types of coulters. In most cases it appears that drilling gives a much better strike, especially of clovers. Comparisons have also been made of pre-sowing surface cultivation methods. Both broadcast seed and drilled seed have been sown on land which has been left uncultivated or ploughed or pitchpole harrowed before sowing. There is a much better strike on land where the surface has been disturbed before sowing. Results vary for the comparison of cultivation methods, but by use of the pitchpole harrow some trials have given a very good strike of sown species. Research is continuing to determine the best time to sow the introduced species, and it is thought that on land where the original cover has been removed, or where there is only a sparse covering of scabweed, it is best to sow grasses and let them establish before the clovers are oversown so that the grasses may form a suitable microclimate for, and give protection to, the clovers.

SPELLING

In the depleted areas of Central Otago rabbit control has allowed some regrowth of native annual grasses where formerly there was only scabweed and bare ground. However, in the less depleted areas which still maintain a weakened tussock cover the regeneration of tussocks is very slow. Where these areas are completely protected from all stock there is considerable general improvement in cover and reseeding quickly takes place, though the tussock species are much slower to recover. This spelling is important where exotics are oversown, as it enables many species to reseed. The tussock recovery is more rapid on the shady faces where the vegetation is protected from wind and sun and where the stock do not concentrate. Trials are continuing to measure vegetational changes on fenced and unfenced areas of tussock and scabweed country over a long period and a new technique is being developed to aid in the accurate assessments of these changes.

FERTILISERS

On many tussock areas, particularly in the high-rainfall regions, spectacular improvement has been obtained by oversowing with clovers, particularly white clover and fertiliser. According to the soil type, lime, phosphate, and molybdenum topdressing have given responses. The accurate assessment of the fertiliser and lime requirements for tussock country has become an important project on which more work is urgently required. A start has been made, but much more information is required before sound recommendations can be made for each class of tussock country. Complex problems are involved, one of the more important being the reaction of the tussock species themselves to the higher stocking intensity which will be brought about by the growing of vigorous clover on the tussock country.

—F. H. THORNTON

* * * *

"Y" SELECTION SWEDE

THE "Y" Selection swede was selected by the Seed Production Officer, Dunedin, for resistance to club-root disease. It was subsequently multiplied for seed production and in preliminary trials confirmed its resistance to club root. He recognised, however, at the time of initial selection that it possessed certain disadvantages, for example, it was inclined to "fanginess" and was fairly deeply embedded in the soil.

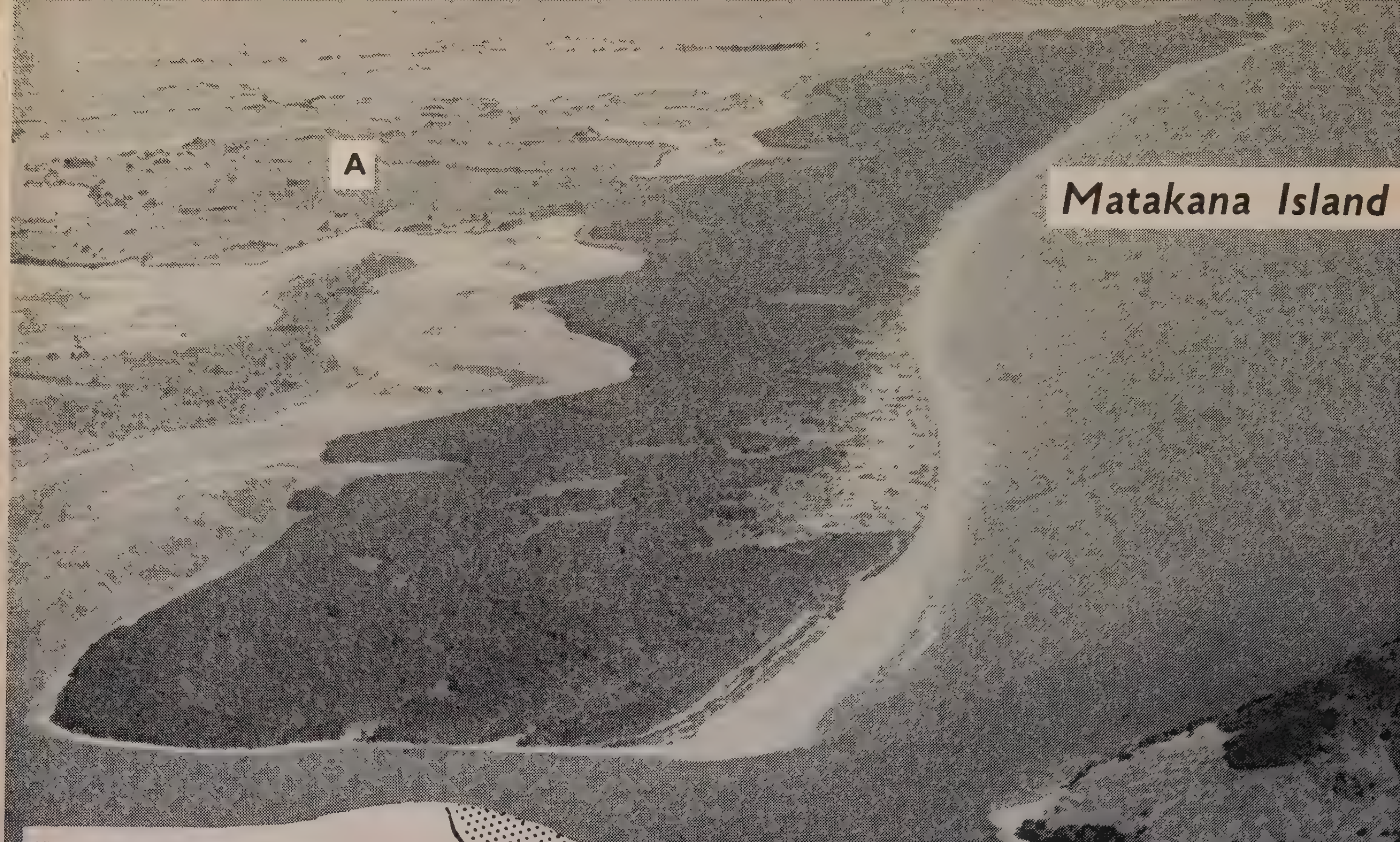
In 1952-53 sufficient seed was available for a large number of strips to be sown in farmers' own crops of swedes, which consisted of the varieties usually sown by the farmers. The crops were selected for situations where club root was expected to occur. Ninety trials were sown, distributed as follows:—

	Trials
Upper North Island	12
Lower North Island	9
Upper South Island	15
Lower South Island	54
Total	90

In each trial a portion of each variety compared was thinned to allow maximum bulb development. Careful observations were made on agronomic features and palatability to stock, and in 44 trials portions were weighed for yield estimations. Club root developed in many of the trials, and where this occurred "Y" Selection swede showed to great advantage, as it was markedly resistant to the disease. Dry rot occurred in a number of trials, and "Y" Selection swede was attacked to the same extent as other varieties. In almost every case, the strike of "Y" Selection swede was thicker than desirable, this undoubtedly being due to the small size of the seed.

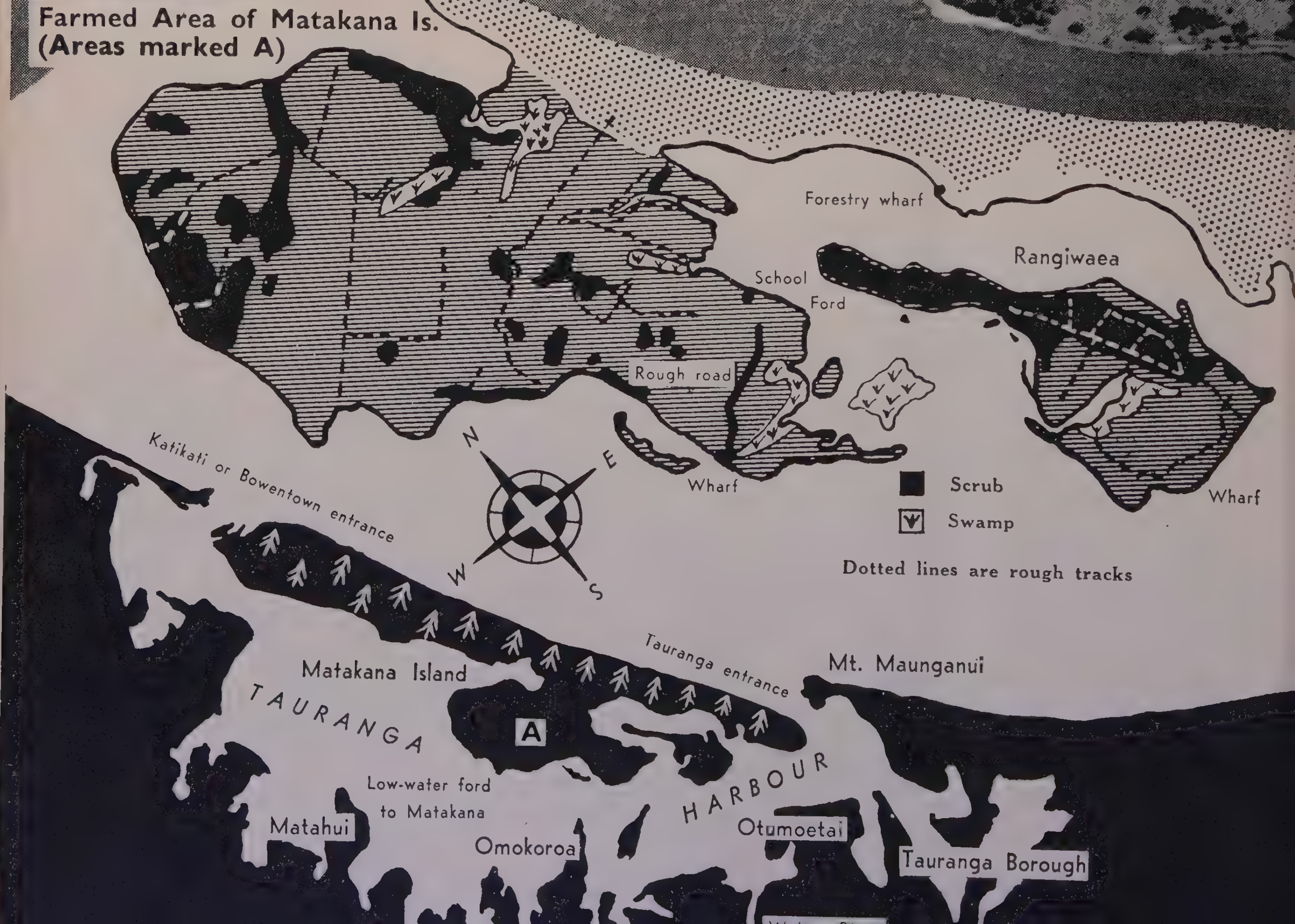
Where thinning was carried out the yields of "Y" Selection swede compared favourably with those of the standard varieties; on club root-infested land, where the disease was severe, the resultant crop of "Y" Selection swede was much superior to those of other varieties. A number of farmers commented favourably on this aspect, considering the selection to have a place as a variety for use on land which had already cropped swedes in the previous year. "Y" Selection swede proved to be long keeping and was quite palatable to stock, particularly when fed late in the season.

—K. COTTIER



Matakana Island

Farmed Area of Matakana Is. (Areas marked A)


Forestry wharf
Rangiwaea
School
Ford
Rough road
Wharf
Wharf
N
E
W
S
Scrub
Swamp
Dotted lines are rough tracks
Katikati or Bowentown entrance
Tauranga entrance
Mt. Maunganui
Matakana Island
A
TAURANGA
HARBOUR
Low-water ford
to Matakana
Matahui
Omokoroa
Otumoetai
Tauranga Borough

Farm Improvement on Matakana Island

By A. V. ALLO, Instructor in Agriculture,
Department of Agriculture, Tauranga

A SMALL community living in comparative isolation is often conservative and slow to accept innovations. Until 4 years ago the few Maori farmers on Matakana Island, which lies between the two seaward outlets of Tauranga Harbour, followed methods traditional to the area and which resulted in serious deterioration of the land. This article gives a brief description of farming on the island and an account of changes arising from organised extension work by the Department of Agriculture. Visits by extension workers, the forming of a Young Farmers' Club, and the holding of several farm schools resulted in intensive co-operation between the Maori farmers and officers of the Department. All were ably assisted by Mr. C. Nicholls, the headmaster of the island school, who co-operated fully in arranging functions and encouraged farmers to use the advice given them.

OVER the past 2 or 3 years Tauranga has featured prominently in the news owing to the development of the deep-water port at Mt. Maunganui and the rapid rural and urban expansion of the surrounding district. In the Tauranga Harbour the district has an asset of considerable value, not only commercially, but also as an attraction for holiday-makers and tourists, who are enthusiastic about the safe swimming and boating that are available.

Geographical Features

One of the striking features of Tauranga Harbour is the natural breakwater which Matakana Island provides. It stretches almost the full length of the harbour from Bowentown Heads to Mt. Maunganui. The island protects the harbour from gales coming from the sea and makes the harbour safe and very attractive.

Separated from Bowentown and Mt. Maunganui by narrow, deep-water channels, Matakana is accessible from the mainland by launch or by a ford at low tide from Matahui, near Katikati.

The area known as Matakana Island is really two islands. The major one is Matakana, and a smaller island, Rangiwaea, of 850 acres, lies in a deep bay off the south-western coast. Rangiwaea is separated from the main island by a narrow channel which is easily forded at low water.

Matakana Island is about 14 miles long and has a maximum width of about 3 miles. The total area is about 12,500 acres, and the land generally is undulating to hilly with quite a large area of fairly level country at the centre of the bulge of the island.

There are two major soil types: The long seaward strip consists of Pinaki sand and the central bulge, on which

Upper right—Improved farmland on Matakana Island. There is a silage pit at right in the middle distance. Lower right—Land reverted to blackberry and weeds after a series of maize crops. This used to be a common sight on the island.

DEVELOPMENT ON MATAKANA ISLAND

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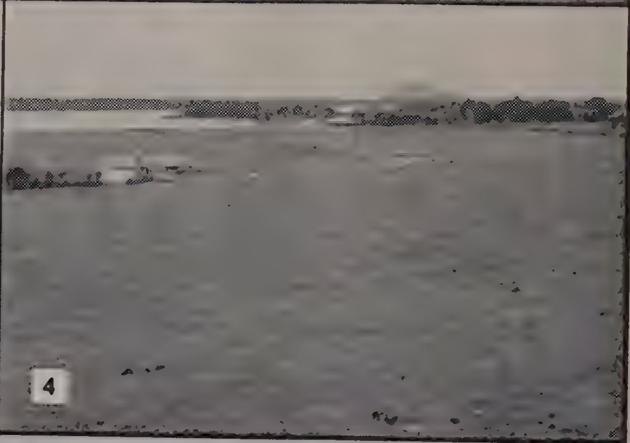
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all the farming is carried out, is of Katikati sandy loam (black phase). There are also several fairly small swampy patches on the island of Pongakawa peaty loam, most of which at present are undeveloped.

There are no rivers or streams on the island, all fresh water coming from springs or bores. Until recently this shortage of fresh water greatly limited stock production.

There is a small, centrally situated wharf on Matakana, from which launches take cream and passengers to Tauranga and there is another on Rangiwaea. At the northern end of the bulge passengers and goods are taken out to the launch on carts and wagons and one farmer takes his cream by dray across the ford to Matahui every day at low tide.

No Formed Roads

There are no formed roads on the island, all routes being little more than unmetalled tracks which are a sea of mud in winter and which give travellers a rough and dusty ride in summer. It is not possible to get a vehicle from one end of the island to the other unless part of the way is travelled along the beach, a slow trip at full tide with water over the horses' bellies. Many of the children are taken to school by horse-drawn coaches and have a long, cold trip in winter, when several of them leave home before daylight and do not return until after dark. The need for good roads is one of the most pressing problems of the island.

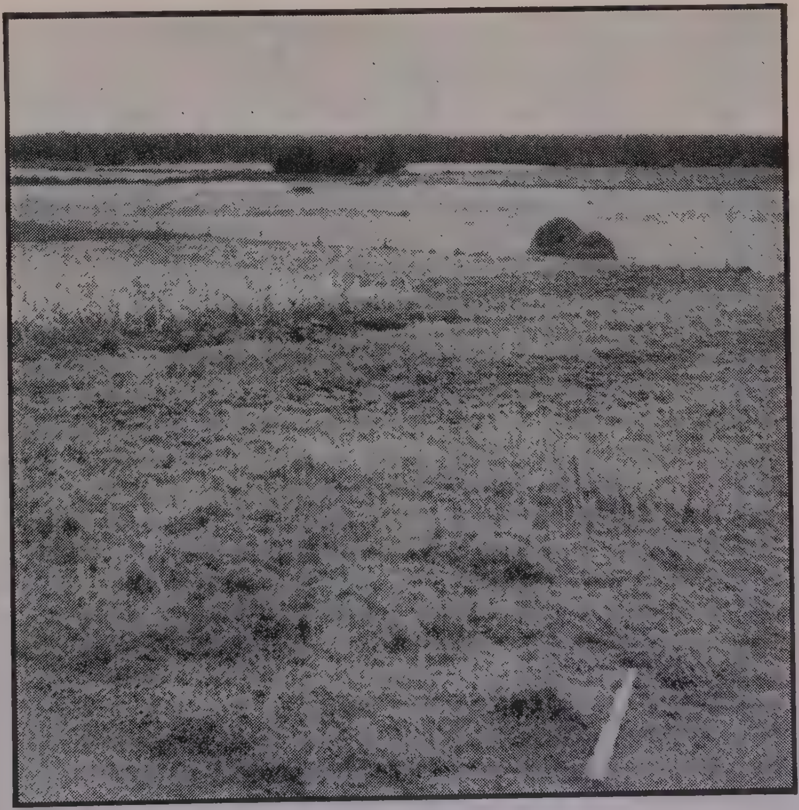
The population of Matakana is between 300 and 400, all except about 40 being Maoris. All the farming is done by Maoris, the other residents being employed in the timber industry, with the exception of four who staff the District High School, which is a well-sited, modern building with a roll of 160 pupils.

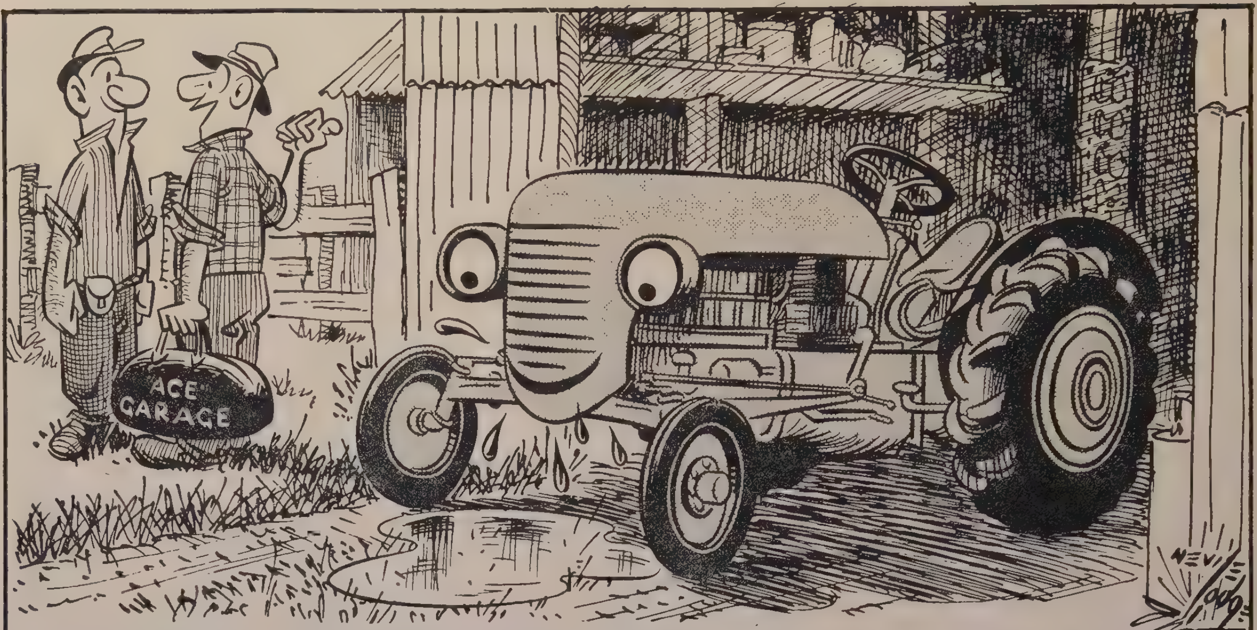
History

The Maoris on the island belong to the Ngaiterangi tribe, who trace their ancestry to the Mataatua canoe. The island was settled very early after the migration in 1350 as the Maoris spread out from Whakatane. The portion of the island now being farmed supported the greater part of this original Maori population, largely owing to its greater natural fertility. There was also a reluctance to settle on the seaward coast because of a prophecy which stated that some day a tidal wave would sweep over this part of the island.

Illustrations opposite: 1—One of the modern, well-kept homes on the island. 2—The Matakana Island District High School is a well-equipped, modern school. The headmaster of this school is taking a prominent part in encouraging the Maoris to apply modern methods in their farming. 3—A typical island track—a boghole in winter and extremely dusty in summer. The horse-drawn school bus traverses this road every school day. 4—A typical island farm. Production from this unit has nearly trebled over the past 3 years. 5—One of the old cowsheds that is being replaced by a modern building. 6—A new cowshed in course of construction. Many new buildings are replacing the old and dilapidated ones.

Above—Gorse- and blackberry-infested country with a poor crop of maize in the background. Below—The old and the new. In the foreground and middle distance are a weedy area and poor maize crop; in the background is one of the farms on which grassland farming has largely replaced cropping.





"IT'S NOT A LEAK—SHE'S JUST FROTHING TO USE UP SOME OF THAT POWER SHE GETS FROM SHELL TRACTOR FUEL AND OIL."

TF5·4

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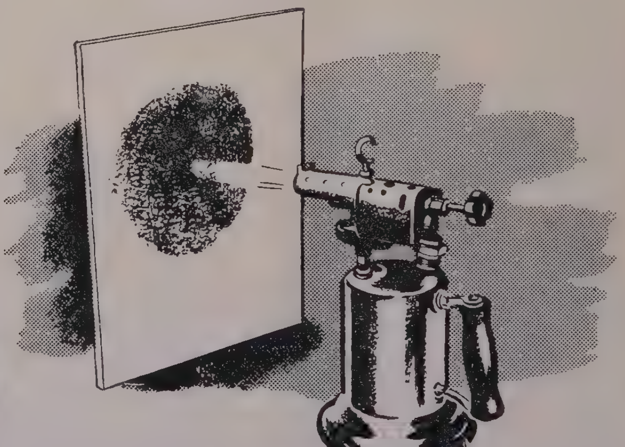

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Left—Weeds and blackberry on land lying fallow after too much cropping. Right—A newly sown area of permanent pasture on land previously in blackberry and weeds.

About 60 years ago all of the long seaward strip (8000 acres) was taken over by the Crown and a sheep and cattle station was established. At this period also portion of the coastal strip was dug over for kauri gum, the area being known as the Paritata gumfields and providing the Maoris with the greater portion of their income.

In 1924 it was decided that this Pinaki soil type would be more suited to trees than to farming, and the whole area was planted in *Pinus radiata*, 400 acres opposite Mt. Maunganui for the Tauranga Harbour Board, 6200 acres for a Melbourne syndicate, and the balance for other groups or private owners.

During the war the thinnings from the main block of pines were used by the Whakatane Board Mills, and the balance of the stand, now being milled, is reputed to contain some of the finest pines in the country. The bulk of the timber is being milled on the island in a sawmill equipped with the latest machinery, and smaller mills are also making substantial cuttings. Most of the timber is being exported to Australia.

In the early days of European colonisation of New Zealand large areas of wheat, maize, pumpkins, kumaras, and melons were grown on the island, and until a few years ago cropping was the major agricultural activity on the bulge. Recently, however, there has been a pronounced change-over from cropping to grassland farming, with very beneficial results to the land and to the Maori settlers.

Size of Holdings

Lack of security of tenure is a hindrance to progressive farming. At present there are 32 farmers on the island, their holdings varying considerably in size. The largest farm is 300 acres, on which 60 cows are milked and which also carries all replacements and 500 breeding ewes.

Today just on 1100 dairy cows are being milked on the island, which has also about 1000 sheep. Of the 4300 acres of Maori land 1000 acres are undeveloped, 1000 acres have reverted to rough pasture, fern, and blackberry, and the balance is in fair to good pasture.

Change in Practices

In January 1950 a Young Farmers' Club was formed on the island, to which at least one person from every farm on the island belongs. This club has been the mainspring behind the change-over from cropping to grassland farming, and has probably played

DEVELOPMENT ON MATAKANA

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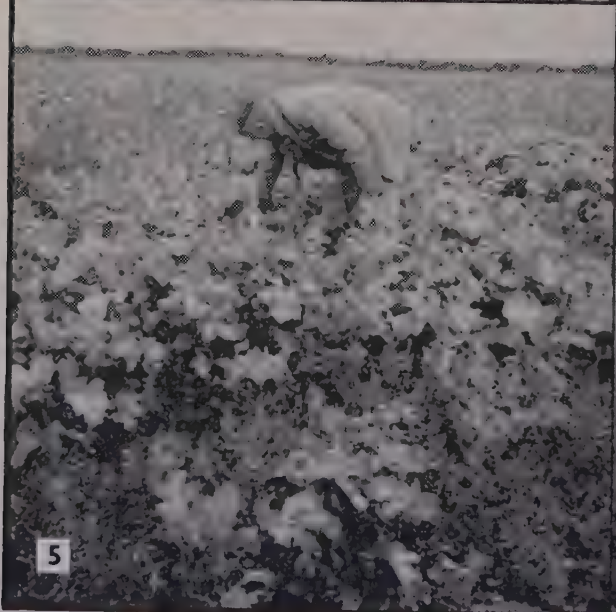

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a greater part in influencing the farming of its district than do most clubs.

At the time this club was formed the Maori farmers were becoming increasingly concerned at the spread of weeds, particularly ragwort and blackberry, and at the poor crop yields. They realised that a policy of grassland farming would yield far more lasting benefits than the old policy of continuous cropping and wished to know how to go about effecting the change in policy, not so much to eliminate cropping as to integrate this activity with a reasonable standard of grassland farming.

Before this the general policy had been to take a crop of maize from an area, followed by a crop of kumaras and further crops of maize, after which the land would lie fallow for a time before another cropping cycle was started. During the fallow the land would be covered with blackberry and fern, and large areas of land at present covered by these weeds offer testimony to the disadvantages of this system of land utilisation. The problem was, of course, accentuated because of the insecure tenure of many of the holdings.

Since 1950 many areas of reverted land have been worked up and sown down to permanent pasture, the dairy cow population has increased, and today dairying rather than cropping supplies the major portion of the farm income. An effort has been made to improve the quality of the dairy stock by the purchase of pedigree herd sires, and numbers of good-quality female dairy stock have also been imported from the mainland.

Today the quality of many of the pastures on the island is still far below what the land is capable of carrying. There are relatively large areas consisting of sodbound paspalum, Yorkshire fog, browntop, and trefoil and covered with scattered fern and blackberry. The improvement of these areas by regrassing, oversowing, topdressing, and fencing would do much to increase the production from the island. Not all of the pastures are poor, and there are many paddocks of good English grasses and clovers from which quite good dairy production is obtained.

Until recently the standard of pasture management was low. Many fences were dilapidated and mobs of stray horses were constantly damaging the fences that were standing. Rotational grazing was rarely practised and pasture utilisation was generally very unsatisfactory. There has been a distinct improvement since 1950. Many fences have been repaired and new ones erected, and large numbers of horses have been disposed of. Today several farms are very well subdivided, some having fences of a very high standard. Rotational grazing is carried out on several properties, the electric fence being used to a considerable extent.

In the last 2 or 3 years there has also been considerable improvement in the way in which stock are carried over winter. Before 1950 most of the dairy cows on the island were wintered on maize stalks plus a little hay, usually of poor quality. Very little silage was made. Cows tended to calve in poor condition. There has recently been a marked increase in the area of grass cut for silage, which is now saved, much of it with the buckrake, on most of the dairy farms on the island. Several areas of lucerne have also been established.

Five years ago there were two tractors on the island; now there are nine. Nineteen deep bores have been sunk during the past 2 years, and as many new water troughs have been installed, there has been a marked improvement in farm water supplies.

Smaller Area in Crops

During recent years the increase in grassland has been accompanied by a considerable decrease in the area in maize. During the war about 1500 acres of maize were grown. The area fell to 400 acres in 1948, and in 1952 under 250 acres were grown. In the 1953-54 season the total area in all crops was less than 300 acres.

Already the benefits of this decrease in cropping can be seen, with areas now in pasture that only a few years ago were carrying stunted, weedy crops. The crops now being grown are better looked after and are giving better yields as a result. The principal crop grown today is kumaras, with smaller areas of maize, potatoes, melons, and onions.

Very good results have followed the use of hormones on ragwort, which had been increasing every year. Spraying with hormones has resulted in a number of properties being virtually cleared of this weed. Much has to be done, however, especially on the blocks of idle land, where flowering ragwort is a constant menace to clean properties nearby.

So far production increases, though steady, have not been spectacular. In 1945-46, a dry season, production was about 90,500lb. of butterfat. In the following season this increased to 120,500lb. In the 1952-53 season butterfat was just under 180,000lb.

There is still a long way to go in the improvement of farming on the island. Though substantial increases have been achieved by some farmers, others are only starting to improve their properties.

The initial period of trial and error is drawing to a close and indications are that the farm improvement plans will be accelerated over the next year or two. Proof of this is the increase in the quantities of fertiliser being used and in the areas saved for hay and silage, the closer subdivision of properties, and the purchase of better-quality stock.

The heartening feature is the fact that here is a group of Maori people, living more or less in isolation, who have embarked on a project of farm improvement and who are slowly but surely seeing the results of their enterprise. Already the state of farms on the island is vastly better than it was a few years ago. Given encouragement and assistance the Maoris could make this island the source of a considerable portion of the total butterfat output of Tauranga County and they would be still be able to do some cropping to supplement farm income.

All photographs by Rendell's.

Illustrations opposite: 1—A poor, weedy crop of maize typical of many grown on the over-cropped portions of the island. 2—A much better crop grown under better husbandry conditions; smaller areas of crop better looked after are giving good returns on the island. 3—Fern and blackberry cover much land that is lying idle because of the difficulty of securing suitable tenure. 4—Preparation of the seed-bed for a new stand of lucerne. 5—One of the first crops of soft turnips ever grown on the island. It is for winter feed and was sown after several crops of maize. The weediness of the foreground is a good warning that the time has arrived to cease cropping and to put the area back into grass. 6—Hay and silage conserved from one of the island's lucerne stands for winter feed.

Establishing a Lucerne Crop

LUCERNE is not a difficult crop to establish, provided attention is given to a few fundamental principles. The soil should be well drained and fertile and should be thoroughly cultivated before sowing. Thorough cultivation assists in the destruction of weeds, a factor of prime importance in the establishment of lucerne, besides ensuring satisfactory consolidation of the seed-bed. As a general rule all land being prepared for the sowing of lucerne should be fallowed and should receive repeated light surface cultivations for several weeks before sowing. This permits germination and destruction of weeds as well as preparing a suitable seed-bed for the lucerne.

Lucerne responds well to lime, and a good practice is to use 1 ton of lime per acre as an initial application. The lime should be harrowed in and the paddock then rolled ready for sowing.

Sowing dates vary from district to district, but as a general rule sowing should be carried out in October to December. Later sowing, up to February, may be beneficial where spring weeds are a problem. The seed may be drilled or broadcast at from 12lb. to 18lb. per acre. If seed is drilled, worn coulters should be used and the seed sown no deeper than 1in. If seed is broadcast, light harrowing will be required to cover it.

Before it is sown lucerne seed should be inoculated with special "culture". This ensures immediate and vigorous activity of the root nodule bacteria that are required for success with this crop. The inoculum used for this purpose is prepared in Auckland by the Plant Diseases Division of the Department of Scientific and Industrial Research. It is usual for the merchant who supplies the seed to the grower to order at the same time sufficient inoculum to be delivered to the grower shortly before he intends to sow. The seed should be mixed with fully reverted or serpentine superphosphate, or preferably a 50-50 mixture of lime and superphosphate mixed several days before sowing, at 2cwt. per acre. Straight superphosphate destroys the culture organisms and may have a detrimental effect on the germination of the seed.

—*W. R. CRAWFORD,*
Fields Instructor,
Department of Agriculture,
Blenheim

Care of Livestock during August

Contributed by the Animal Research Division

CALF REARING

CALVES should be fed their mothers' milk for at least the first 2 days. This is important, as the first milk, known as colostrum or "beastings", contains substances which increase a calf's resistance to scours. Since over-feeding is an important cause of this trouble, feed not more than 6 pints daily during the first week, 7 pints during the second week, and 8 pints during the third week. If whole milk is fed, there is no need to give more than 7 pints per day. If scours occur, a supply of a sulpha drug should be obtained from a veterinarian immediately, as the drug is very effective when used promptly. Calves should not be kept in a calf paddock. When 2 to 3 weeks of age they should be rotationally grazed ahead of the cows. This will ensure that they always have access to good, fresh pasture, which they will eat readily. Where good pasture is available, calves can be weaned quite satisfactorily at 8 weeks. Excellent articles on the good rearing of dairy stock appeared in the April, May, and June 1954 issues of the "Journal", and these should be read carefully by all dairy farmers.

CARE OF THE CALVING COW

Cows about to calve should be brought into a handy paddock so that they can be kept under supervision. If a cow has difficulty in calving, veterinary assistance should be sought as soon as it is obvious that the presentation is not normal and in any case within 6 hours of the start of labour. Unskilled interference exhausts the cow and makes the veterinarian's task more difficult or even impossible. Veterinary assistance should also be sought if the cow does not clean within 48 hours. Do not hang weights on the afterbirth.

FEEDING AFTER CALVING

Autumn-saved pasture is the best food for newly calved cows, but it must be grazed in small breaks which the cows will clean up in about 2 hours. The cows should continue to receive as much silage as they will eat and if the pasture is short and sappy, they should also receive hay.

SELECTION OF CALVES FOR REPLACEMENTS

The full sisters of high-producing heifers should always be kept, as should the daughters of Merit Sires with a high progeny test. Providing they are sturdy, the calves of very old cows with good life-time performances should always be kept, and there is no reason why the calves of well-bred heifers should not be kept. The twin of a bull calf should never be kept. Twin heifers may be kept with safety provided they are not too small, especially if they are born early in the season.

MASTITIS

Milk from each quarter should be examined with a strip cup before milking. If it shows any abnormality or if the udder appears inflamed, treatment with penicillin should be started at once. Three tubes should always be injected at 24-hour intervals, even if the milk appears normal after injection of the first tube. Prompt treatment early in lactation will often save a quarter from becoming weak or even blind.

STERILITY IN COWS

If difficulty was experienced in getting cows in calf last summer, now is the time to seek veterinary advice to prevent similar trouble this year. Facilities for diagnosing infectious infertility are available at both the Wallaceville and Ruakura Animal Research Stations. Specimens must be submitted through Veterinarians or Livestock Instructors. Effective control depends on accurate diagnosis.

CARE OF LAMBING EWES

About 10 per cent. of all lambs are either born dead or die during the first week. These losses can be reduced by careful shepherding. Many lambs and some ewes can be saved by skilled assistance during lambing. Always use a reliable lubricating antiseptic on hands and wrists. Faulty presentations must be corrected. A lamb should never be forcibly pulled away when a leg or the head is turned back. A number of lambs die from suffocation through the cleanings remaining over their nostrils. These are very easily removed. Where necessary lambs should be assisted to get a drink. This is particularly important where ewes have very large teats. Drawing away a few squirts from these will reduce their size and enable the new-born lambs to suckle. Ewes with very large teats, very small teats, badly placed teats, or defective udders should be marked for culling. A big percentage of their lambs will die. Many lambs which die during cold or wet weather would survive if they got a good drink soon after birth.

LICE ON CALVES

Calves and yearlings may become very lousy during late winter and early spring. Control can be effected by the use of suitable dips, sprays, or washes of which those containing D.D.T. or B.H.C. are most effective. Repeated treatments may be necessary, as the eggs are difficult to destroy.

WORMS IN HORSES

Red worms reduce the efficiency of farm horses. Drenching with phenothiazine now will prevent the pastures becoming contaminated with eggs and thus reduce the chances of reinfestation in spring. As phenothiazine causes very severe reactions in some horses, dosing should be done under veterinary supervision wherever possible. If this cannot be arranged, divide the dose recommended on the package into 5 parts and give it over 5 days.

DISEASES OF CHICKS

Navel disease is contracted in the incubator, which should be scrupulously cleaned and fumigated with formalin between batches of chicks. Pullorum disease can be controlled only by repeated blood testing of all stock, immediate disposal of all reactors, and thorough cleaning and disinfection of premises after each test.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during May and for the 10 months ended 31 May 1954, with comparative figures for the same month and 10-monthly period of 1952-53, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

	Tons			
Period	Creamery	Whey	Total	Percentage inc. or dec.
May 1954	2,741	104	2,845	—
May 1953	3,945	157	4,102	—
Increase or decrease ..	—1,204	—53	—1,257	—30.643
10 months ended 31/5/54	141,301	2,980	144,281	—
10 months ended 31/5/53	159,267	3,120	162,387	—
Increase or decrease ..	—17,966	—140	—18,106	—11.150

Butter in store at 31 May 1954 was 15,222 tons

CHEESE

	Tons			
Period	White	Coloured	Total	Percentage inc. or dec.
May 1954	4,580	+32	4,612	—
May 1953	5,536	—	5,536	—
Increase or decrease ..	—956	+32	—924	—16.691
10 months ended 31/5/54	97,588	219	97,807	—
10 months ended 31/5/53	101,482	140	101,622	—
Increase or decrease ..	—3,894	+79	—3,815	—3.754

Cheese in store at 31 May 1954 was 13,629 tons

If these figures are converted into butterfat equivalent, there is a decrease of 9.52 per cent. in butterfat graded for the 10 months as compared with the corresponding period of the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place from time to time they are not necessarily a true indication of production trends.

Land Development; Oats and Barley

Seasonal Notes by the Extension Division

PLANS should be made now for grassing down virgin scrub or reverted areas. There is still great scope for the expansion of land development throughout the Dominion and with modern development practices it is possible to bring scrub land into a state of high productivity within 2 years of grassing down. A progressive policy of land development is essential if the rate of expansion of primary production is to keep pace with the needs of the Dominion's growing population.

CLEARING HILL COUNTRY

Before the first giant discing some preliminary clearing must be done. Heavy fern and short scrub can be burnt standing if there is enough dead material to carry a fire. Light scrub 4ft. or 5ft. high should be crushed with a scrub bar or roller. A heavy swamp harrow or a length of railway iron behind a tractor is useful to break down light scrub and make it carry a fire more efficiently. Heavy scrub must be crushed with a tracklaying tractor and scrub bar. Crushing should be done during summer for burning in early autumn. After heavy scrub has been fired unburnt sticks and roots will have to be cleaned up and burnt or they will interfere with cultivation when the seed-bed is being prepared. These sticks will not rot in 12 months and partial burning preserves them. Areas of gorse should be treated in a similar manner to manuka. A successful summer or early autumn burn is valuable. A thick establishment of gorse seedlings will follow the fire when the autumn rains occur and the first giant discing should be delayed until the seed has germinated.

DISCING HILL COUNTRY

Giant discing on hard clay soils may have to be delayed until the rain has softened the ground enough for the discs to penetrate. Autumn discing allows a good winter fallow during which the upturned roots of scrub and fern will rot and the soil will weather to a stage when it can be readily worked to a seed-bed the following summer. A double discing is essential on clay soils. Much of the discing will be on the contour and furrows turned uphill at the first cut of the discs tend to fall back to their original position. In addition with one cut of the discs there is an untouched slice on the centre not turned up for weathering. The second cut ensures that no soil is left unturned and that the depth of discing is sufficient. Hollows that have been missed or disced too shallow then receive a deeper cut. It is often necessary to weight the discs to ensure this. The depth to which the discs penetrate is often deceptive, especially on hard ridges, and the double cut improves these areas.

—*C. E. BALLINGER*

* * *

BARLEY

BARLEY for grain is generally spring sown, the period of sowing extending from August to October. For grain the seeding rate is from 1½ to 2 bushels per acre, and 1cwt. of superphosphate should be sown with the seed. The main varieties grown for malting are Kenia, Research, and Golden Archer, though a considerable proportion of grain of these varieties, particularly when below malting quality, is also used for feeding. Kenia has made a rapid advance since it was first grown a few years ago. It is short and stiff in the straw and stands well for direct heading. Kenia is preferred by growers on the heavier barley soils and gives good yields of average to good malting quality. Research stands well for direct heading, yields well, and is fairly free from neck break. It is regarded as being more suited to the lighter barley soils. The chief drawback to this variety is that its grain does not find such favour with maltsters as that of Kenia and Golden Archer. Golden Archer is not as reliable in yields as the others. It matures later and as it requires good growing conditions to fill out and yield well, it is more frequently grown in medium to heavy soils.

The Cape variety supplies some grain for feeding and is also grown for winter greenfeed. Other greenfeed varieties are Black Skinless and Wong. Black Skinless is the quickest growing and produces the biggest bulk of initial feed and also recovers after grazing better than Cape. Wong, a newly introduced variety, is winter hardy and though not so impressive in its initial growth, recovers well after grazing to give a good spread of greenfeed production. Black Skinless is the first to run to seed in spring and is not as drought resistant as Cape. Fed off crops of all these varieties may be allowed to produce a grain crop for seed.

—*R. M. COMER*

* * *

OATS

THOUGH advances in mechanisation have correspondingly reduced the need for oat growing, this hardy cereal remains important as a crop to produce grain, chaff, and greenfeed. Oats succeed best on friable loams in cool, moist climates, but are adaptable to a wide range of soils and climates and to both autumn and spring sowing. They are superior to all other cereals for chaffing and as a cereal greenfeed may be surpassed by barley only for late sowings or in quality of spring feed or by ryecorn in districts with more severe winters. A mixture of oats and legumes—either Scotch tares, peas, or field beans—is eminently suitable for ensiling. The buckrake and forage harvester have quickened interest in silage and the use of the oat-legume combination for this purpose might well be more widely adopted. Oats may be grown at any stage in the rotation, though they commonly follow turnips, swedes, rape, or wheat—frequently as a "catch" crop providing spring or autumn greenfeed. When autumn sown for grain or chaff they may also provide useful winter and early spring grazings. When oats follow wheat the wheat stubble should be burnt off and the area deep ploughed immediately. The soil is then worked down with discs or cultivator and harrows to a rubbly tilth that will not "cake" over winter. When the crop is to be grown after turnips, swedes, or rape surface cultivations with discs and harrows should prove sufficient except on very heavy soils or weedy land where ploughing is advisable. When the crop is to follow grass the lea should be ploughed early and fallowed before working down for sowing.

OAT VARIETIES

White varieties, of which Abundance and Onward are most popular, are grown for milling and for chaff. Other white varieties include Royal Scot, Spitfire, Binder, and Achilles. Abundance is relatively strong strawed and resistant to straw break, but is subject to lodging on heavy soils during wet summers. The more recently introduced Onward with its large, plump grain and coarser straw is more resistant to lodging, but shows a tendency to straw break. Royal Scot is rather tall and coarse strawed, though no more resistant to lodging than Abundance. It appears better suited to drier soils. The fine-strawed Binder is a good chaffing oat. Though autumn-sown white varieties will provide some grazings, coloured oat varieties provide the best forage crops. Algerian is the standard greenfeed and chaffing oat, being relatively rust resistant and a good winter grower. The variety Duns is favoured in Southland, where it provides valuable spring grazings and can be carried through to maturity for grain that is sought after as feed for stud stock. In recent years the oat Winter Greys has been finding favour as an autumn-sown greenfeed variety in South Canterbury.

—*H. A. ARTHUR*

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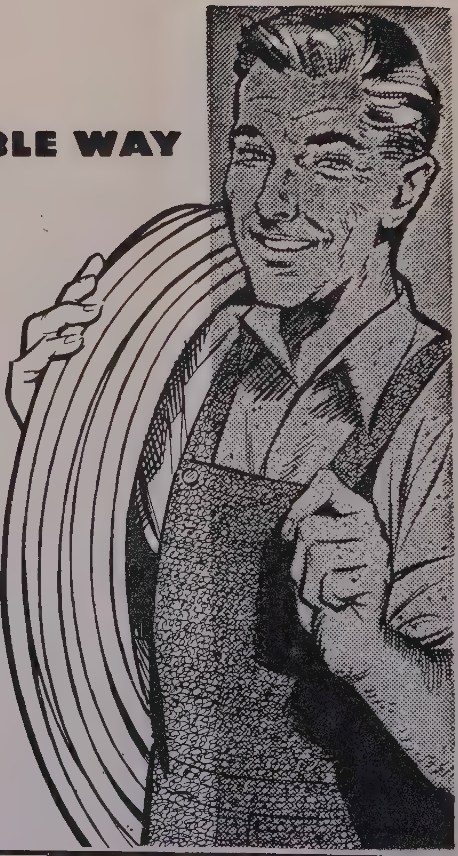

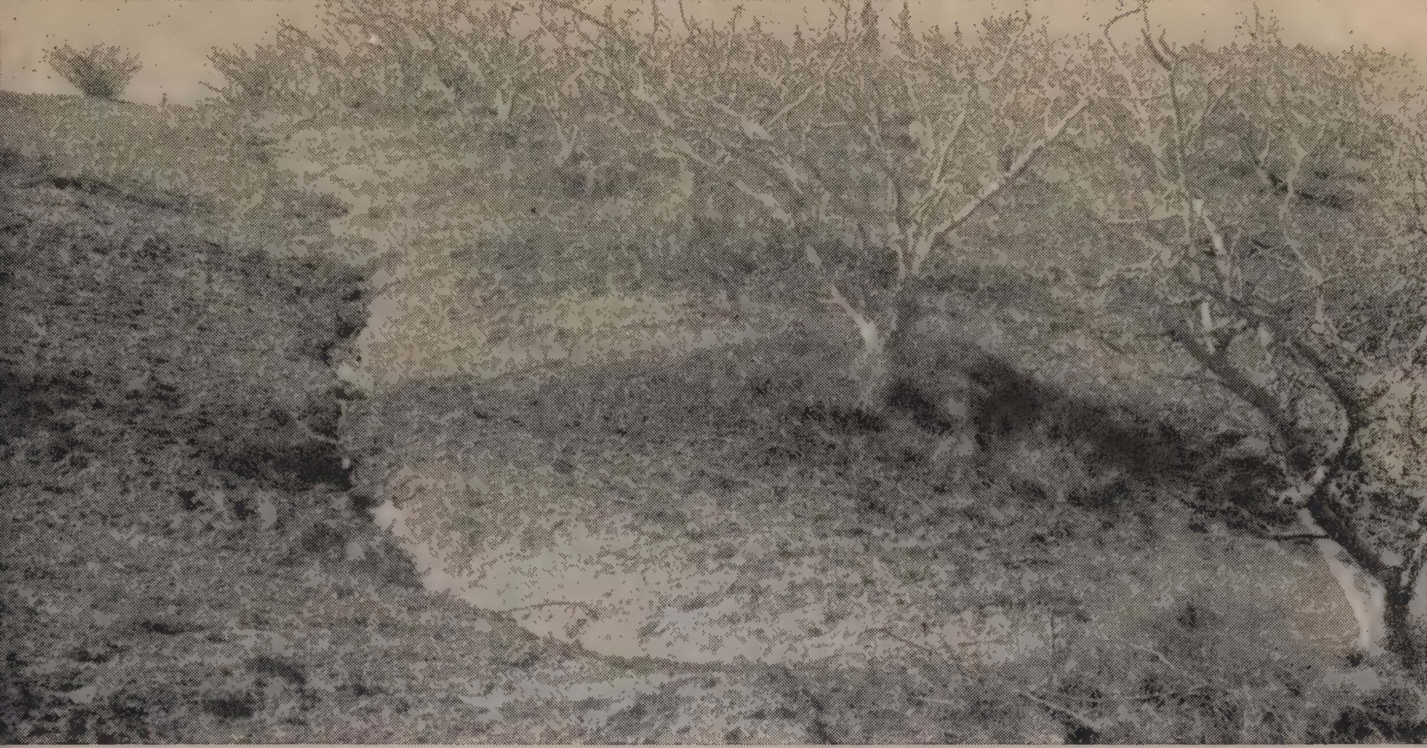

HEADING PHOTOGRAPH: The effects of erosion on a hillside orchard in clean cultivation and left bare in winter. Cawthron Institute photograph.

Management of Orchard Soils

UNTIL fairly recent years fruit growers appeared to give little thought to soil management in orchards and the general effect of cultivation practices, but seemed to expect that the fertility of soil should remain unimpaired regardless of the treatment given. Opinions have so changed that today soil management in orchards is recognised as of major importance and a subject which should be considered by all fruit growers. In this article G. S. Northcote, Horticultural Instructor, Department of Agriculture, Motueka, discusses various practices which are calculated to maintain and improve soil fertility in the orchard.

NOT very many years ago an orchardist was judged by the appearance of his orchard soil. If the soil was absolutely smooth and level without a blade of grass or the smallest weed and with a 6in. depth of the finest tilth, popular opinion said that the owner must be a good, conscientious, and efficient grower. In reality such a grower was ruining the soil structure, destroying organic matter, and leaving the topsoil in the best condition for rapid erosion by wind and water. Every wind blew clouds of dust away and every rain caused streams of muddy water to run into creeks and rivers, which finally carried the good topsoil out to sea.

Fortunately this method of soil mismanagement has been almost eliminated, though some growers still cultivate far too frequently in a misguided endeavour to conserve soil moisture.

Soil Water

There are three types of water in the soil—hygroscopic, capillary, and excess. Of these the hygroscopic water is so firmly held by the soil colloids that it is not available to the plant roots. Good soil management requires good drainage to get rid of the excess water. It is not proposed to discuss drainage here, but simply to reiterate that attention to drainage must be one of the first considerations in good soil management.

The capillary water only is of any use to plant life. This water is held in varying amounts according to the type and condition of the soil. Light, sandy soils hold very little moisture over dry periods and heavy clays are inclined to hold too much in wet periods.

For a long time it was considered that constant cultivation prevented a so-called rise of capillary water to the surface and so avoided loss by evaporation. It has now been proved that this capillary rise does not take place or is so slight that it can be disregarded. The disproving of this theory has provided another reason for eliminating superfluous cultivation.

The most suitable type of soil for orchards is a medium loam containing the maximum quantity of organic matter. This type of soil will absorb and hold capillary water like a sponge while allowing excess water to drain away, and it is the ideal soil for plant growth. Unfortunately not a great quantity of this ideal soil is to be found, so the required conditions usually have to be built up by the grower.

Organic Matter

Both heavy clay and light sandy soils can be brought nearer to the ideal by an increase in the organic matter in the soil, as this is the key to fertile soils and plant life. It is desirable to explore all methods whereby the organic matter in the soil may be increased.

At present the most common method of improving the organic status of the soils in New Zealand orchards is to sow in autumn cover crops of some reasonably fast growing plant and disc the crops under in spring. Fortunately the plough, which must have been responsible for killing many feeding roots annually in some orchards, has been almost eliminated from fruit culture. Constant use of the plough also left a plough sole, which was further consolidated by the tractor wheel and finally formed an impervious layer. The tractor wheel running in the furrow will do much more harm to the soil structure than when running over the surface of the soil.

The cover crop in general use is blue lupins. This leguminous crop rapidly grows a large bulk of green material and has the added advantage of increasing the supply of nitrogen through its root nodules. As nitrogen is an expensive element to buy, any crop which will supply it free is worth while for this alone. Lupins are usually sown in late January after the last cultivation for the season, and the crop is incorporated with the topsoil in August. It is only necessary to work it roughly into the soil. Lupins do not always succeed, especially among big trees or if planted too late. In the United States of America it is frequently impossible to grow any leguminous cover crops owing to the arsenic toxicity built up in the soil by constant spraying with lead arsenate. This condition has not yet been found in this country.

Other green cover crops in common use are oats and vetches, black barley, and ryecorn, all of which have been

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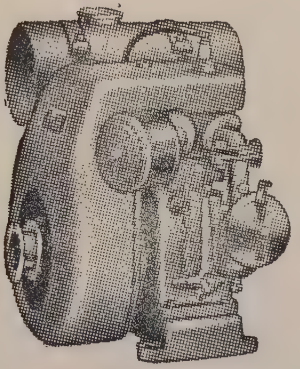

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[*Sparrow*

Good cover crops assist to maintain soil fertility. This crop of blue lupins is ready to be disced in.

very successful on many orchards and help to supply a good rotation with blue lupins. In fact any crop which will grow a good bulk of green material between January and August can be usefully employed for this purpose.

In addition to improving the organic matter content of the soil cover cropping has further advantages. By beginning growth in autumn the crop competes with the tree for soil moisture and so indirectly helps in the ripening of fruit, buds, and wood, and by covering the soil in winter the crop plays a large part in the prevention of erosion.

Another method of obtaining a cheap cover crop is to cease cultivating in January and to allow the weeds to grow. This is not so useful as sowing a crop, because weeds usually do not produce such a bulk of suitable material and they often have very tough stems when mature. Many orchards produce an annual cover of winter grass (*Poa annua*) which helps to prevent erosion but does not add greatly to the organic matter. However, weeds are better than nothing and whatever method is used cultivation should always cease in January.

A very interesting development in the Moutere Hills orchard area has been the use of subterranean clover (*Trifolium subterraneum*) as a cover crop. This clover is establishing itself quite well on the clay soils of the district and is causing a big improvement in the fertility of these comparatively poor soils. It is sown in January in a well tilled soil. It is somewhat slow in establishing and makes very little growth until the following spring, but growth is then quite vigorous and a good bulk of material is produced by November, when the clover seeds. The common practice until now has been to allow it to grow unrestricted until November and then to disc it under after sufficient seed has set, cultivation then being continued until January. On some orchards the trees seemed to receive a severe setback, especially in the second year of this treatment if the spring was dry. Obviously this was due to lack of moisture and nitrogen. A variation of this technique has been adopted to reduce the competition for moisture and the practice is to mow the clover in spring as soon as it reaches a height of 4in. Mowing is repeated whenever the clover grows to about 4in. until it seeds in November and dies off. No cultivation is done. This will probably become the common practice for treatment of this crop on the Moutere Hills.

Doubtless this total elimination of cultivation will seem very radical to some people. It is really only logical. The main object of good soil husbandry is to build up the organic matter in the soil.

Every time the soil is cultivated with disc and harrow organic matter is destroyed. There is no surer and no quicker way to ruin the soil than by the constant use of cultivation equipment.

A very interesting experiment has been carried out over a number of years on a citrus orchard in California. Some plots have been treated in the usual way by growing cover crops and carrying out a modified programme of cultivation; other plots have received no cultivation and the weeds have been controlled by hand hoeing in the first years and later by spraying with oils and weedkillers.

Despite the cover crops the plots receiving cultivation have slightly less organic matter in the top 6in. of soil than the non-tilled plots; the plots are more or less equal in the deeper soil. The weight of feeding roots of the trees in non-tilled soil was twice as great as the weight of those in the cultivated plots. The majority of the feeding roots in the non-tilled soil were in the more fertile top 2ft.

The greatest difference between these soils was in the water-penetration rate. Three successive applications of .45in. of water were made; 13.9 minutes were required for the total of 1.35in. to soak away in the tilled soil compared with 1.5 minutes in the non-tilled soil.

The main disadvantage of the non-tillage was that more irrigations were required in the year, owing to the very fast movement of water to the lower depths and to the large quantity of feeding roots in the top 2ft. of soil.

This method of non-tillage is also practised under irrigation in Australia, but may not be suitable in this country unless irrigation is available.

The chief points proved in this experiment were that cultivation destroyed the organic matter added by the cover crop and also all the feeding roots near the surface. Therefore it is obvious that cultivation without cover crops will soon make the soil infertile.

Mulching

Another method of controlling weeds, supplying organic matter, and avoiding cultivation is the application of a mulch to the orchard. The mulch may be freshly cut green material, straw, hay, stable manure, or sawdust. The main features of a good mulch are:—

1. It must be applied thickly, certainly not less than 6in. and preferably 9in. to 10in. deep.
2. It should be applied when the ground is holding its full content of capillary water.
3. It should be allowed to become gradually incorporated in the soil by natural means. These conditions apply particularly to sawdust, which has a very high carbon : nitrogen ratio. Any dry material which has a high carbon : nitrogen ratio will cause a nitrogen depressing effect if it is incorporated with the soil quickly. This can be overcome by the addition of extra nitrogen. However, it is preferable to leave the mulch undisturbed on the surface and let it slowly decompose. Many growers have used this system with great benefit to the health of the trees and a good increase in crop. It is somewhat costly in both time and money, especially if the mulching material has to be purchased.

Permanent Grass Sward

In 1949 Professor T. Wallace of Long Ashton in delivering the annual Cawthron Lecture to a crowded audience in Nelson astounded many people by suggesting that orchards could well be put down into permanent grass. This system had been tried previously on some orchards in New Zealand with rather disastrous results which were brought about by failure to carry out the proper cultural requirements for grassed orchards.

Advantages of Permanent Sward

The surest way to build up soil fertility is to sow down into pasture, and nothing will build up the organic matter content of the soil more satisfactorily. The most obvious reason, apart from the vast quantities of material supplied by decomposing roots and tops, is the fact that none of this material is destroyed by cultivation and its accompanying oxidisation, which is accelerated by the bare earth being exposed to bright sunlight.

Most soils contain sufficient nutrients for plant growth, but not all the supply may be in a form available to plant roots. A soil analysis will frequently show that there is plenty of a certain nutrient in the soil and yet the tree will show every evidence of a shortage

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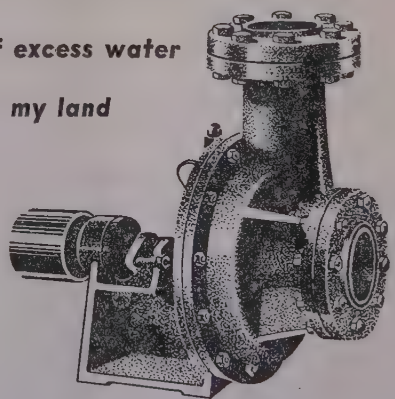

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of the same element. This is because the element is held in the soil in a form not available to the plant roots. Cover crops, especially grasses, can take up some nutrient elements which are unavailable to tree roots and then build them into other forms which, when returned to the soil, are available to the trees. This is especially true of magnesium, which is often deficient in trees in Nelson orchards. Grassing down, however, will not overcome deficiencies of elements in the soil.

Another big advantage of a permanent sward is the ease of working with machines and of walking over the orchard. A machine will do much more harm to the soil structure when working over bare ground, especially when a wheel is down in the plough furrow, than when working over pasture. Work such as pruning, thinning, spraying, and harvesting are all much more easily and pleasantly carried out.

Disadvantages of Permanent Sward

The disadvantages of a permanent sward may be stated briefly: Need for extra nitrogen in early years; need for constant mowing; possible need for extra water in a very dry period in early years. Also, permanent grass has not been successful with peaches and nectarines.

Nitrogen

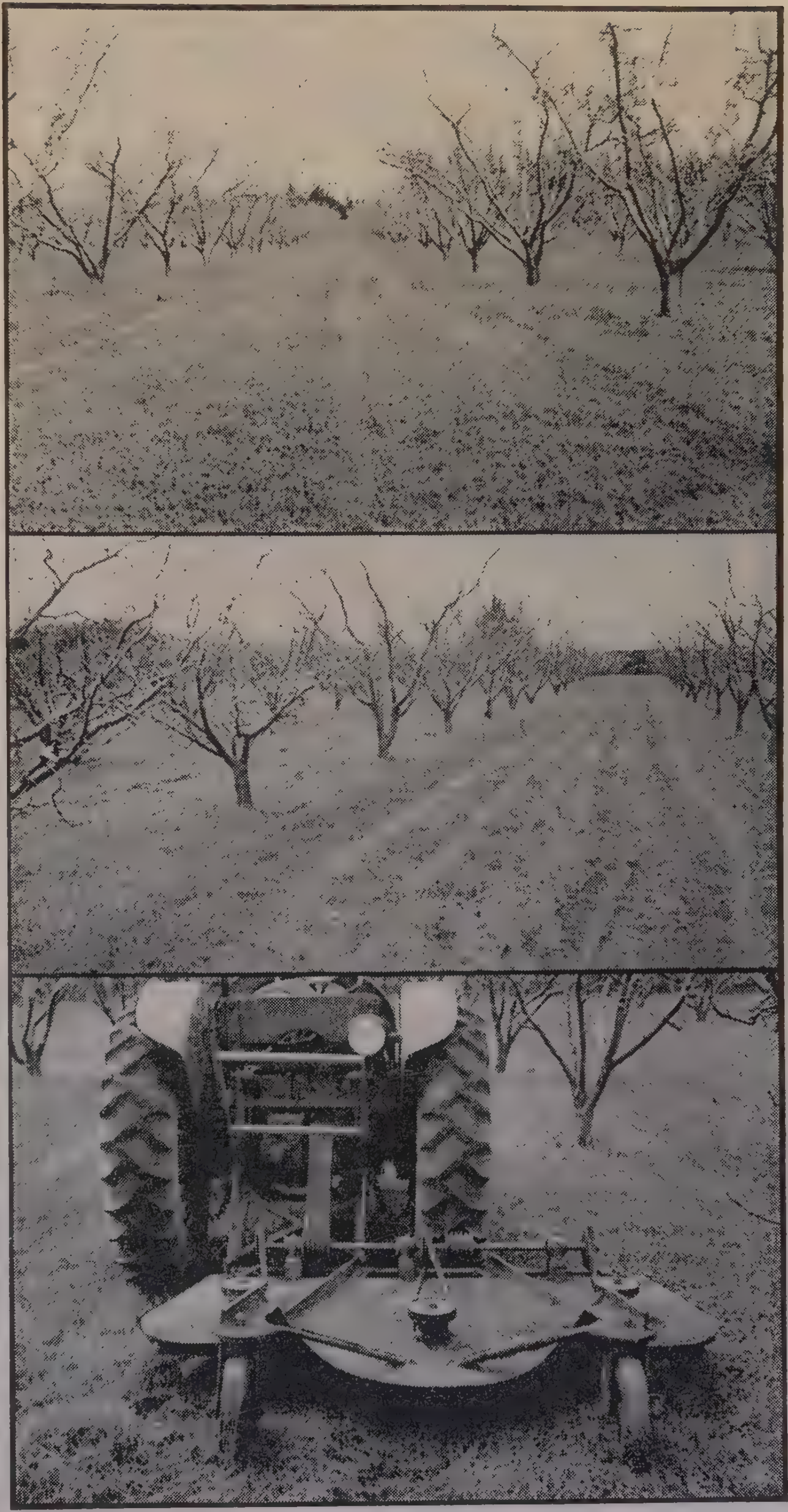
A temporary nitrogen deficiency always occurs in the early years after grassing down has been done and it is most apparent in the third and fourth years. Extra nitrogen may be applied by giving 2lb. of sulphate of ammonia per tree above the normal fertiliser mixture. The new method of applying nitrogen by the addition of urea to the spray mixture at the rate of 5lb. to 100 gallons for four sprays over the "pink to calyx closed" period is the best means of overcoming this deficiency, as the trees receive the direct benefit of the nitrogen at the time it is most needed. Soil applications may not always have become available by blossoming time, when the demand for nitrogen is greatest.

Irrigation

It is possible under New Zealand conditions that trees may suffer during a very dry period, especially before the organic matter content of the soil has been built up. Grassing down will overcome the moisture loss by evaporation, but will increase the loss by transpiration. Constant mowing serves to keep this transpiration loss to a minimum. To date orchards in permanent grass in Nelson Province have not suffered, but no bad drought conditions have occurred. It seems advisable for growers to be aware of the danger and to be prepared to overcome it with irrigation if available. Though there is no doubt about the success of grassing down where all the requirements are met, there may be a risk if this water problem cannot be overcome. All the other factors can be dealt with easily.

The essential requirements for permanent grass are:—

1. Constant mowing during the spring and early summer so that the grass is never more than 3in. high.



Upper—A vista, photographed in October, of an orchard which was grassed down the previous autumn. Middle—The stage at which grass should be mown. It must not be allowed to grow too long. Lower—A rotary mower offset from the tractor to cut close to the trees. It is operated from the power take-off on the tractor.

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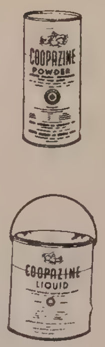

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2. Application of extra nitrogen during the early years, to overcome the deficiency of nitrogen which inevitably occurs, until such time as the grass is returning sufficient nitrogen to the soil by decomposing organic matter and the nitrogen fixing abilities of the clovers in the sward.
3. To the above two requirements may be added the means to supply irrigation water in some form should a very dry season occur before the trees have fully adapted themselves to the new conditions.
4. Sowing a good seed mixture in the first instance is very important.

It is very essential to establish a good sward of high-quality grass rather than to allow the grass just to come in to the orchard naturally. A recommended sowing would be:—

1½ bushels of perennial ryegrass (Permanent Pasture or Mother Seed)

3lb. of white clover (Permanent Pasture or Mother Seed)

To obtain a greater bulk of material and a quicker cover (an advantage on hills where erosion is a consideration) ½ bushel of short-rotation ryegrass may replace ½ bushel of perennial ryegrass. This is especially recommended for the Moutere Hills orchards, where an addition of 1lb. of subterranean clover would also be beneficial.

It is unnecessary to sow the light grasses like chewings fescue and browntop. These grasses will eventually establish themselves in any case.

The grass should be sown in autumn by the normal cultural methods for sowing pasture, and mowing should begin as soon as there is sufficient growth to warrant it.

Too much emphasis cannot be placed on the necessity for constant mowing. This is the essential operation in successful management of grassed orchards. If a grower is not prepared to mow as often as required, then it would be much better to avoid grassing down.

The grass should be left where it falls. Growth immediately round the tree trunk is best controlled by mulching.

Digging round Trees

If digging round trees has been a regular practice, this can be continued, provided the digging is not too deep. It is better to apply a mulch. Sawdust is very useful, especially if the orchard is in permanent grass. If the trees have not been cleaned round for a number of years, it is dangerous to start digging. First, there are probably a lot of feeding roots in the uncultivated soil, and second, and more important, the sudden exposure of the tree trunk to the sun, after years in the shade, may cause severe sunburning. This sunburn of the trunk can cause the trees to die and may seriously affect the production of the trees, often for some years. The only satisfactory way to deal with an accumulation of rubbish round trees is to mulch heavily. The mulch will kill the grass and weeds, which will gradually decompose.

Young Orchards

It is not sound to grass down newly planted orchards because of the adverse effect on young trees. Cover crops grow easily among young trees, and as many crops as possible should be grown during the first few years. Lupins should be sown in January and disced in autumn, when oats or ryecorn may be sown and disced in late spring. This can be continued for about 5 years, with only the barest minimum of cultivation to prevent competition with the young trees for moisture over the late spring to early summer period. The orchard may then be sown to permanent grass.

Intercropping among young trees is not recommended, though sometimes economic reasons seem to make it necessary. The fertility of the soil is impaired instead of being built up for the years of heavy cropping which lie ahead and there is a risk of introducing diseases such as verticillium wilt. It is far better for the owner of a young orchard to work for wages elsewhere than to rob his soil in the formative years.

Main Considerations

1. The plough has no place in orchard soil management except on those orchards where the soil is too stony for discs.
2. Use of cultivation implements such as discs and cultivators should be reduced to the minimum.
3. Soil organic matter must be built up.
4. A cover of some sort should be kept on the soil for as much of the year as advisable.
5. Discing should leave a trash mulch on the surface and not be continued until all the material has been buried in the soil.
6. Mulching with any available material is very useful.
7. Subterranean clover is very effective on the Moutere Hills. It should be subjected to the minimum cultivation and mown where a mower is available and the ground is in a suitable condition.
8. Grassing down should be seriously considered, especially when all the requisite conditions can be fulfilled, and if done, should be thorough.

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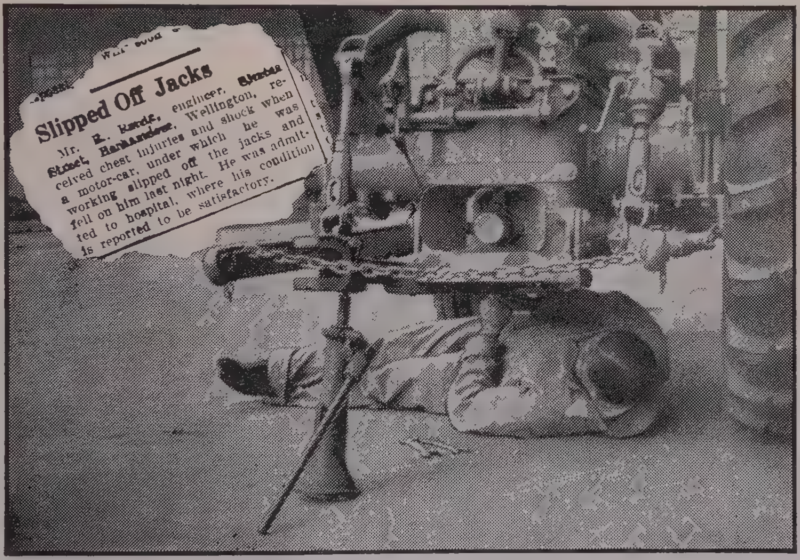
Care Necessary when Using Jacks



Slipped Off Jacks

Mr. R. [illegible], engineer, [illegible] Street, [illegible], Wellington, received chest injuries and shock when a motor-car, under which he was working slipped off the jacks and fell on him last night. He was admitted to hospital, where his condition is reported to be satisfactory.

NEVER get under a tractor or any other vehicle that is resting on a jack unless there is a safety block in position to arrest the fall of the vehicle should the jack fail or slip. The safety block should be strong enough to take the full weight of the vehicle.

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—*C. M. B. OLIVECRONA, Machinery Instructor,*
Department of Agriculture, Wellington

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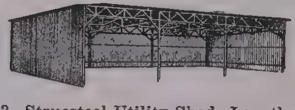

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HEADING PHOTOGRAPH: Poorer class sandstone hill country where the fertility has been built up slowly and steadily by the use of lime and fertiliser. On this country progress should be more readily and speedily obtained in future with the assistance of molybdenum.

Molybdenum Responses in the Auckland Province

TRIALS with the application of sodium molybdate were first laid down in New Zealand on ironstone soils near Kerikeri in the Bay of Islands about 1945 at the instigation of E. B. Davies, Senior Chemist, Department of Agriculture's Rukuhia Soil Research Station, Hamilton, and in co-operation with the local Instructor in Agriculture. These gave a slight response, which indicated that it was worth while applying about 2oz. of sodium molybdate per acre on these soils in addition to the basic needs of superphosphate, lime, and potash. In this article J. E. Bell, Fields Superintendent, Department of Agriculture, Auckland, describes responses to molybdenum on various soils in the Auckland Province.

THE first molybdenum trials were followed by others, and one laid down (again at the suggestion of Dr. Davies) near Wellsford in North Auckland is still giving a marked response to sodium molybdate applied in August 1950. Experiments indicate that positive results may be obtained from practically all of the soils of the steep country of North Auckland, including the greywacke and steep volcanic hills of the Te Kie suite, for example, Te Kie gravelly loam. (A suite is a group of soils which is derived from a similar parent material.)

Trials also indicate that the soils of the same suites on the lower slopes of these hills (for example, Marua clay loam and Pakotai clay) also respond. Responses have also been obtained from the sandstone country, including the steep hills (for example, Puhoi clay loam) and the sandstone soils of the lower slopes (for example, Whangaripo clay loam and Warkworth clay) and the gumlands formed from sandstone (for example, Waikare sandy clay).

Definite responses have been obtained from the rolling Waikare clay derived from claystone and shale, but not so far from the less mature soils (Mata clay) or the more mature soils (Wharekohe silt loam) of this suite. A good response has been obtained on Autea clay loam, derived from sandstone and mudstone.

Varying Responses

On the basalt country of North Auckland no responses have been obtained so far from the immature soils (for example, Kiripaka and Ohaeawai loams) and but slight responses from the semi-mature soils (Ruatangata clay loam), and it is not until the mature ironstone country (for example, Okaihau gravelly clay loam) is reached that a positive slight response is obtained. On sands the position is obscure, some positive and some negative responses being secured.

To sum up it might be said that responses are expected on many of the soils of North Auckland.

In South Auckland the sandstone soils and soils derived from greywacke (for example, Marua clay loam and Te Ranga stony clay) show responses, but on other soil types little response has yet shown. Many of the trials in this area are new and insufficient time has elapsed to list the responses. However, on present indications the soils of the pumice belt give no response to molybdenum. Insufficient trials

Typical better-class sandstone country near Warkworth. The persons in the photograph are standing on the site of a trial where a marked response was later obtained from molybdenum alone on country where there is no record of lime or manurial application.

have been laid down to test thoroughly the responses of the young volcanic soils in this region.

Past Treatment a Factor

The response obtained seems to depend largely on the past treatment of soils with lime and phosphate. If the pasture is a high-class one resulting from good treatment with major elements, the improvement that can be made is small, and the response from molybdenum may be therefore only small if any. If no application of lime and phosphate has been made and the sward is consequently very poor, marked responses may be obtained in spite of the soil being by past standards very short of lime or phosphate. However, there is no evidence to show how long such responses will last. Usually where two elements are in short supply, both have to be applied to make much progress. It was surprising therefore to observe a major response from an application of 2½oz. of sodium molybdate per acre to sandstone hill country which experience has shown is very much lacking in lime and phosphate. On such country the progress from repeated applications from lime and phosphate was very slow. The same occurred on a poor volcanic soil (Pakotai clay) lacking in lime, phosphate, and potash.

All Needs Should be Met

Quite good responses were obtained from molybdenum in the absence of phosphate, lime, and potash, but better over-all results can be expected with these materials than from molybdenum alone. Therefore, wherever possible all the needs of a soil for lime, phosphate, potash, and molybdenum should be met. On steep hills where it is difficult or impossible to apply lime and where the cost would not warrant the application of phosphate considerable progress may be expected from the use of sodium molybdate on its own. Sodium molybdate at 1oz. or 2oz. per acre evenly spread may present some difficulty unless it can be sprayed on by air or mixed with a little superphosphate, say, at ½cwt. to 1cwt. per acre. Later the increased production may make sufficient finance available to supply more phosphate.

Warning

Feed with too high a molybdenum content can cause poisoning in stock. Hence it might be considered dangerous to apply molybdenum to soils that do not require it. It might be considered definitely dangerous to apply molybdenum to soils already well supplied with this element, particularly peat soils. Before applying molybdenum farmers should seek the advice of their local Instructor in Agriculture. Trials or the taking of soil samples to test needs of this vital element may be necessary.

A New Era

It might well be shown that the molybdenum discovery heralds the dawn of a new era for the hill country of the northern parts of the Auckland Province. Production on much of this country has been declining. Molybdenum is expected to halt this decline and its intelligent use will result in an increase in production from the hills. On the hard clay hills which are expected to respond to molybdenum the fern, manuka, and bidi-bidi can be expected to be kept at bay and eventually eliminated with the assistance of the good swards now much more speedily and easily attained with the help of molybdenum. These clean swards should then produce much more store stock and wool than in the past.

Meteorological Records for May

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	57.3	+ 1.0	72.6	38.0	10.30	17	+ 3.11	3.28	17	143.6
Auckland	160	58.6	+ 2.0	70.7	43.9	9.12	14	+ 4.33	3.48	17	140.6
Tauranga	10	54.8	+ 1.2	69.0	35.2	7.52	15	+ 2.39	3.10	18	167.8
Ruakura	131	52.4	+ 1.0	70.5	26.6	5.41	11	+ 0.91	1.13	22	133.7
Rotorua	975	51.9	+ 1.7	68.0	32.3	5.09	11	— 0.19	1.54	18	145.5
Gisborne	12	54.0	+ 1.1	71.6	35.3	4.28	12	— 0.49	3.22	18	147.0
New Plymouth ..	160	55.4	+ 1.7	70.8	38.8	3.08	12	— 2.99	0.65	18	134.0
Karioi	2125	47.6	+ 2.1	65.0	25.2	3.32	10	— 0.70	1.20	21	
Napier	5	54.3	+ 1.5	70.8	37.0	1.45	10	— 1.89	0.70	18	156.5
Wanganui	72	54.6	+ 1.6	72.1	35.3	1.23	15	— 1.89	0.36	20	140.6
Palmerston North .	110	53.3	+ 2.3	74.1	32.0	1.53	11	— 1.79	0.52	20	137.9
Waingawa	340	51.4	+ 1.9	70.7	31.2	1.47	12	— 2.58	0.30	22	150.8
Wellington	415	53.8	+ 2.5	66.8	41.0	3.66	13	— 0.90	0.98	5	139.8
Nelson airfield ..	5	50.1	+ 1.6	66.9	30.2	8.46	12	+ 5.42	2.41	22	162.9
Blenheim	12	51.4	+ 1.8	65.4	32.8	5.12	11	+ 2.59	1.31	11	162.1
Hokitika	15	50.5	+ 2.3	62.9	35.4	7.48	15	— 1.80	1.59	21	97.9
Hanmer	1270	45.8	+ 1.0	65.0	25.0	1.13	11	— 3.35	0.23	19	130.1
Christchurch ..	22	49.3	+ 1.7	64.6	32.7	1.72	10	— 1.13	0.80	19	143.4
Ashburton	323	48.3	+ 1.6	68.4	28.0	1.56	7	— 0.99	0.65	18	145.1
Timaru	56	49.2	+ 2.4	65.1	32.4	1.94	10	+ 0.41	0.47	18	123.6
Alexandra	520	45.0	+ 2.1	65.1	23.5	0.82	9	— 0.09	0.31	20	120.1
Taieri	80	49.0	+ 3.1	66.8	27.9	1.68	12	— 0.41	0.57	19	
Invercargill airfield	0	48.2	+ 2.9	63.0	27.0	1.75	16	— 1.99	0.42	20	86.7

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HEADING PHOTOGRAPH: The herbaceous border is useful for screening a boundary fence. Franzman photo.

The Perennial Flower Border in Spring

THE perennial border, though an established feature in the garden, can be redesigned every few years, thus providing a pleasing change. When well prepared and planned it will give a display of flowers throughout summer. In this article K. H. Marcussen, Horticulturist, Department of Agriculture, Christchurch, describes the establishment of a perennial border and the work that should be carried out in an established one during spring. The cultural recommendations can also be applied to the mixed border, in which most flower gardeners grow some herbaceous perennials. Flower garden work for August is dealt with by M. Joanna Lockie, Horticultural Instructor, Department of Agriculture, Auckland.

MOST of the plants used in the perennial border are commonly termed herbaceous perennials. They produce fresh top growth every spring and this dies down after flowering or dries off during winter if not removed. The crowns of these plants are generally quite hardy and only in the coldest districts is winter protection necessary.

Most are fibrous rooted and will, after a few years, grow into tight clumps, in which the older portions in the centre get little nourishment or moisture as compared with the outside portions. It is consequently necessary to replant them every 3 or 4 years to get the best results.

There are, however, some with fleshy roots, such as gypsophila, peony, lythrum, platycodon, and oriental poppy. Most of this type dislike disturbance and may "sulk" for a season after being transplanted. If such plants are doing well and not showing signs of impoverishment, they are better left alone.

These characteristics should be kept in mind when a new border is being laid out or an old one rearranged.

Selection of Site

In the average flower garden there is not much choice for the site of a herbaceous border. It generally has to follow one of the sides of the garden and will often be in front of a boundary fence or a hedge. However, it is important to consider the aspect, as one side of the garden may mean a cold and wet position with little morning sun during spring when the plants begin growing, and the other side may provide a situation where the plants are bathed in sunshine during the first half of the day.

The ideal location is one with an easterly or northerly aspect, well sheltered, but away from trees and vigorously growing shrubs whose roots will compete with the herbaceous plants for nourishment and moisture.

The width of the border will vary greatly, but less than 6ft. cannot be recommended if a good selection of plants is desired, as that will not provide enough space for variation in height; 8ft. will allow much more scope.

A border with walks on both sides can be made, but calls for much greater care in planning, as generally one side will be in the shade of the taller-growing plants necessarily growing in the centre. For such a border a much greater width is desirable.

A deep medium loam is best, but with good management either a heavy or a light soil can be used, provided drainage is adequate.

Preparation of Ground

When the site has been chosen and the edges of the border are determined preparation of the soil should begin without delay to enable natural settling of the bed before planting.

Drainage is of great importance and must be attended to first, if required. Few plants like waterlogged conditions.

Any perennial weeds such as twitch and docks must be removed, as it will not be easy to dig them up once the bed is planted.

The whole bed should then be dug over to a depth of at least 2ft. If the subsoil is heavy, this operation becomes very important. After the top spit has been removed the next layer should be thoroughly broken up and coarse organic material such as old stack bottom or half-rotted compost incorporated. The heavier the subsoil is the coarser this material should be and also the more liberally it should be applied to improve drainage and

HERBACEOUS BORDER PLANTS

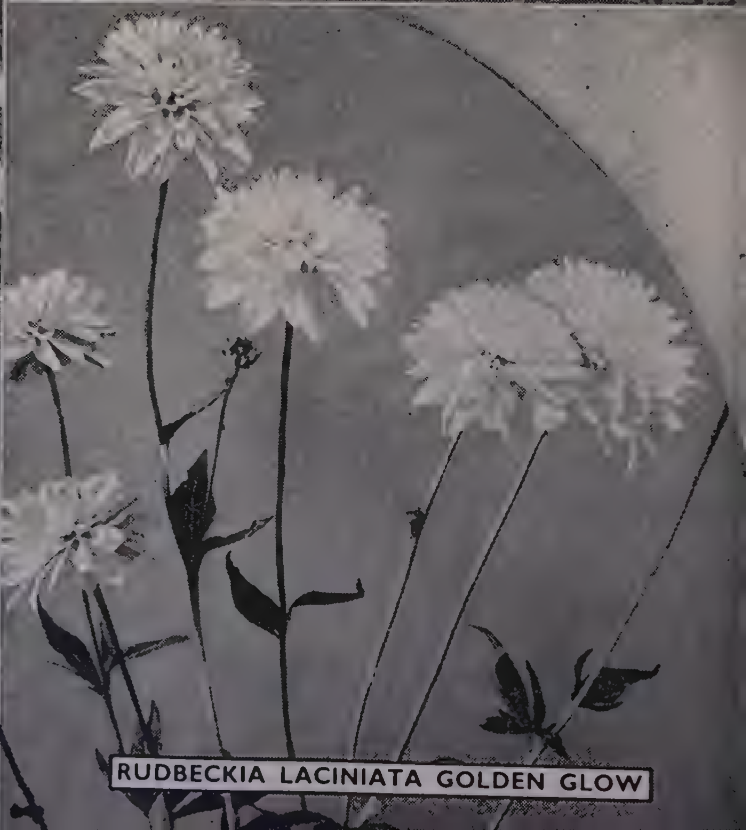
AQUILEGIA LONG-SPURRED HYBRID

HELIANTHUS

ASTER ALPINUS

PAPAVER ORIENTALE

GYPSOPHILA BRISTOL FAIRY



RUDBECKIA LACINIATA GOLDEN GLOW

aeration and so give better growing conditions. When the topsoil is being replaced as much fine organic material as is available should be mixed in to provide a good tilth.

Liming will probably have to be done, as most herbaceous plants prefer a neutral soil; 2oz. to the square yard is a safe application on most types of soil when a border is being prepared.

After a fortnight fertiliser should be applied in the form of basic slag at 6oz. to the square yard or superphosphate at 4oz. to the square yard. Basic slag is preferable for heavier soils.

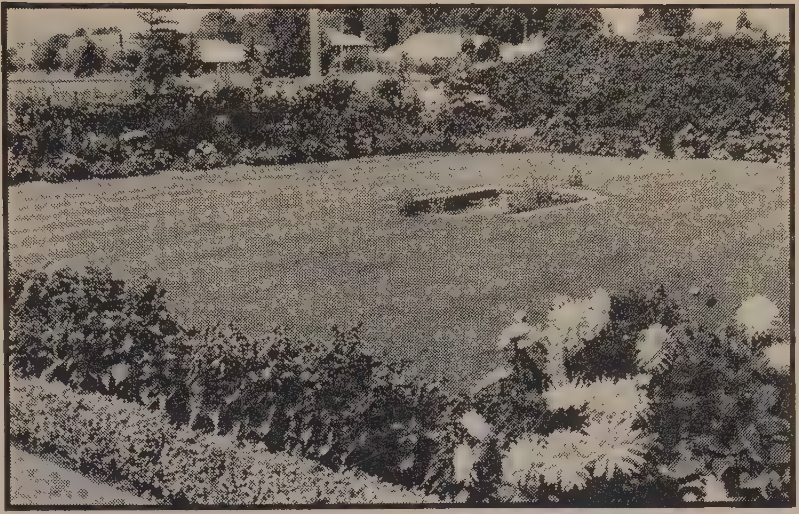
The border should now be left until ready for planting, except for an occasional hoeing to keep the soil open and to suppress any weeds that may germinate.

Planning the Arrangement

Next in importance to the preparation of the soil comes the laying out of the border. This job demands a lot of consideration and can be carried out in the comfort of a fireside chair. A plan of the border should be drawn on paper and as decisions are made regarding the various plants to be used the positions should be set down.

A border may be planted in one colour, but it is then very difficult to provide a display throughout the season, and the mixed border is usually favoured.

The selection of plants may depend on source of supply. Many home gardeners establishing a perennial border are able to obtain a number of plants from friends. Among these will probably be plants like aquilegia, delphinium, golden rod, helenium, helianthus, and shasta daisy, and perennial types of aster, phlox, and scabious. These plants should be spaced in groups at intervals throughout the border to give substance and a bold effect.



[Franzman

A perennial border gives a delightful background for this garden.

Though the height of plants is generally graduated with the tallest at the back, this should not be done too regularly. It gives a much better effect if this rise in height is brought about by placing clumps of varying height irregularly, instead of placing them in definite lines along the border. It is better to place a few plants of the same variety together in a clump than to scatter them individually through the border.

Apart from height, colour combination and contrast are of great importance and must be given attention.

The period and length of flowering are other factors that must be taken into consideration. Proper placing in relation to these factors will determine the display of colour throughout the season.

Furthermore, some of the herbaceous plants prefer shade and moist conditions. These can be set in positions which are not suitable for most other plants.

Distance between groups will vary according to the height and spread of

Some Herbaceous Perennials, their Flowering Season, and Range of Height. Colours Vary in Varieties

Spring

Alyssum saxatile	1ft.	Iberis	1ft.
Arabis	¾ft.	Primula	½ft. to 1ft.
Aubrietia	½ft.	*Saxifraga crassifolia*	1ft.
Doronicum	1ft. to 4ft.	*Saxifraga cordifolia*	1⅓ft.

Late Spring and Early Summer

Aquilegia	1½ft. to 3ft.	*Nepeta mussini*	1ft.
Geum	1ft. to 2ft.	Paeonia	1½ft. to 3ft.
Heuchera	1ft. to 2ft.	*Papaver orientale*	1ft. to 3ft.
Iris germanica	2ft. to 4ft.	Physostegia	3ft.
Iris laevigata (Kaempferi)	2½ft.	Polygonatum	2ft.
Linaria	2ft. to 3ft.	*Chrysanthemum coccineum (Pyrethrum roseum)*	2ft.
Lupinus	2ft. to 5ft.		

Summer

Achillea	1½ft. to 5ft.	Geranium	1ft. to 3ft.
Aconitum	2ft. to 6ft.	Geum	1ft. to 2ft.
Anchusa	2ft. to 5ft.	Gypsophila	1½ft. to 3ft.
Astilbe	1½ft. to 5ft.	Helianthus	3ft. to 8ft.
Bocconia cordata	6ft.	Heliopsis	3ft. to 5ft.
Campanula	1ft. to 5ft.	Hemerocallis	3ft.
Canna	2ft. to 5ft.	Hosta (Funkia)	1½ft. to 2½ft.
Centranthus	2ft.	Inula	2ft. to 6ft.
Chrysanthemum maximum	1ft. to 3ft.	*Iris germanica*	2ft. to 4ft.
Coreopsis	1ft. to 4ft.	Linum	1ft. to 2ft.
Dahlia	2ft. to 5ft.	Lupinus	2ft. to 5ft.
Delphinium	2ft. to 6ft.	Lychnis	1ft. to 3ft.
Dianthus	½ft. to 2ft.	Lythrum	2ft. to 3ft.
Dictamnus	3ft.	Monarda	2½ft.
Echinops	2ft. to 5ft.	*Nepeta mussini*	1ft.
Erigeron	1ft. to 2ft.	Oenothera	1ft. to 2ft.
Eryngium	2ft. to 5ft.	Paeonia	1½ft. to 3ft.
Gaillardia	2ft.	Pentstemon	1½ft. to 3ft.
Galega	2ft.	Phlox	1ft. to 4ft.
		Platycodon	1ft. to 2ft.
Potentilla	1ft. to 2ft.	Tradescantia	2ft.
Scabiosa	2ft. to 4ft.	Verbascum	2ft. to 4ft.
Sidalcea	2ft. to 3ft.	Verbena	1ft. to 3ft.
Statice	1ft. to 2ft.	Veronica	1ft. to 3ft.
Thalictrum	2ft. to 4ft.		

Late Summer and Early Autumn

Aconitum	2ft. to 6ft.	Kniphofia	1½ft. to 5ft.
Anemone japonica	3ft.	Tritonia	2ft. to 5ft.
Aster	1ft. to 5ft.	*Nepeta mussini*	1ft.
Chrysanthemum	1ft. to 5ft.	Pentstemon	1½ft. to 3ft.
Dahlia	2ft. to 5ft.	*Chrysanthemum coccineum (Pyrethrum roseum)*	2ft.
Delphinium	1ft. to 6ft.		
Echinacea purpurea	3½ft.		
Helenium	2ft. to 5ft.	Rudbeckia	2ft. to 6ft.
Helianthus	3ft. to 8ft.	Solidago	2ft. to 5ft.

Autumn

Aconitum	2ft. to 6ft.	*Physalis alkekengi*	2ft.
Aster	1ft. to 5ft.	Rudbeckia	2ft. to 6ft.
Chrysanthemum	1ft. to 5ft.	Solidago	2ft. to 5ft.
Helianthus	3ft. to 8ft.	Schizostylis	2ft.
Kniphofia	1½ft. to 5ft.		

Winter

Helleborus	1ft. to 2ft.	*Petasites fragrans*	1ft.
Iris unguicularis (stylosa)	1¼ft.	Primula	½ft. to 1½ft.
Kniphofia	3ft. to 5ft.	Schizostylis	2ft.

Some Herbaceous Perennials which Will Tolerate Much Shade

Acanthus	1ft. to 4ft.	Cimicifuga	3ft. to 5ft.
Aconitum	2ft. to 6ft.	Hosta (Funkia)	1½ft. to 2½ft.
Anemone japonica	3ft.	Helleborus	1ft. to 2ft.
Astilbe	1½ft. to 5ft.	Primula	½ft. to 1½ft.

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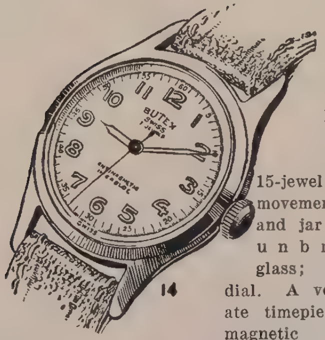

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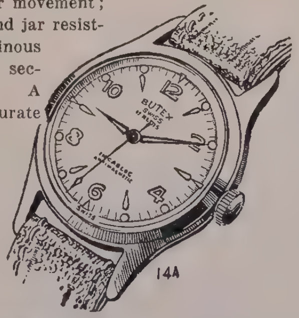

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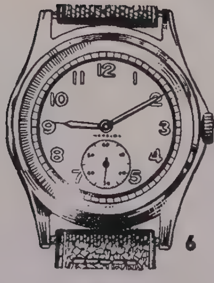

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the plants. As a general recommendation plants growing up to 18in. high should be 1ft. apart, those 18in. to 2½ft. high 2ft. apart, and those 2½ft. to 4ft. or more not less than 3ft. Between individual plants in a group distance should range from 9in. to 18in. accordingly.

If all plants must be purchased, it may be wiser to concentrate on a smaller border for a year or two, after which many plants will be large enough to be divided. Another solution would be to plant sections with annuals temporarily and later fill them with perennials.

Bulbs, dahlias, and chrysanthemums can also be used in the border to give a longer period of flowering.

Planting

If the ground has been well prepared and a good plan has been made, planting is a small job. When planting is done during spring it should be completed before growth begins.

Satisfactory planting cannot be done if the ground is too wet. If soil clogs on the boots, it is better to keep off the border until it has dried up and heel in any plants that may arrive.

Working from the plan, the gardener should proceed to mark out where all the plants are to be placed and begin planting from one end, and so avoid tramping over the finished area. The roots of each plant should be checked over and any damaged or exceptionally long pieces cut off cleanly. The hole should be dug big enough and the soil packed firmly round the roots, with the crown of each plant about 1in. below soil level.

Any plants that appear very tender can be lightly mulched with straw or other light material.

Once the border has been planted a copy of the plan should be kept for reference. It will then be possible to check the identity of any plant, whether it is flowering or not.

Snails and Slugs

Snails and slugs must be watched for when the plants begin growing, as the young, tender shoots may be considerably damaged by these pests. The best control is a bait of bran and metaldehyde. This is made by mixing 1oz. of metaldehyde powder with 2½lb. of bran moistened with molasses. Small heaps of this should be placed near the haunts of snails and slugs in the evening.

Established Borders in August

In many home gardens the herbaceous border will have been mulched in autumn after it was cleaned up both as a manurial measure and as a protective covering during winter. This mulch should now be incorporated in the topsoil, where it will improve both tilth and water-holding capacity of the soil.

Division

Where division of plants is desirable and this has not been done in autumn it should be attended to before growth begins.

After the plants have been lifted the ground should be dug over and enriched with organic material, as described for a new border.

[*Douglas Elliott*

Gazanias are among the dwarf plants used in the front of the border. In mild districts they will flower most of the year if they are planted in a sunny position.

When the plants are being divided it is best to tear them apart with two forks placed back to back or to sever them with a sharp knife. Always discard the centre and woody portions in favour of the vigorous shoots nearer the outside of the clump. The plants should not be allowed to dry out; if they have to be left out of the ground for any length of time, they should be kept out of the sun and wind and either sprinkled with water or covered with wet scrim.

Thinning out

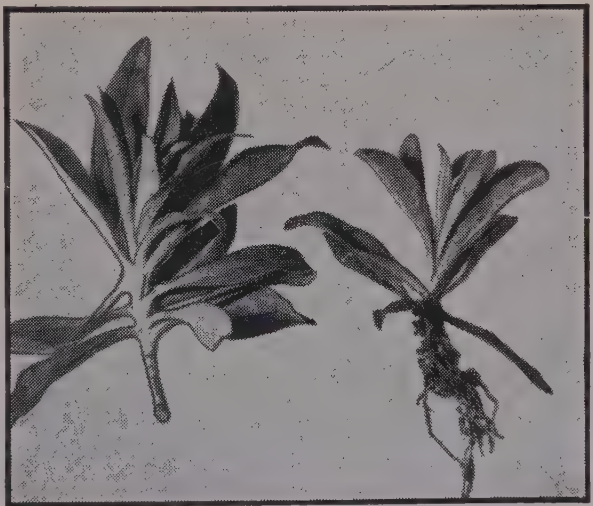
When it is not necessary to divide plants it may be advisable to reduce the number of shoots and so regulate the amount of growth. This will ensure stronger and better plants. Make sure the shoots are cut off close to their base; otherwise this cut may only act as a "stop" and result in additional new shoots developing.

Cuttings

To increase some of the slower growing plants by cuttings is best done when the plants are starting to grow.

Select vigorous plants and cut some of the shoots off when they are about 4in. long. Remove the leaves and trim the base just below a node and insert the cutting in sandy soil in a propagating frame. If a frame is not available, a few cuttings can be accommodated under a preserving jar. They should be kept well watered and closed up for a week to 10 days and shaded from direct sun. From then on ventilation should be gradually increased and in a few weeks root growth will begin.

Treatment with one of the rooting hormones will assist, but the use of these will not justify less care of the cuttings while they are forming roots.



Left—A cutting of a herbaceous plant prepared for insertion.
Right—A cutting of the same plant after it has rooted.

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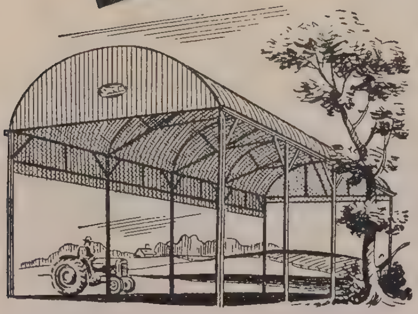

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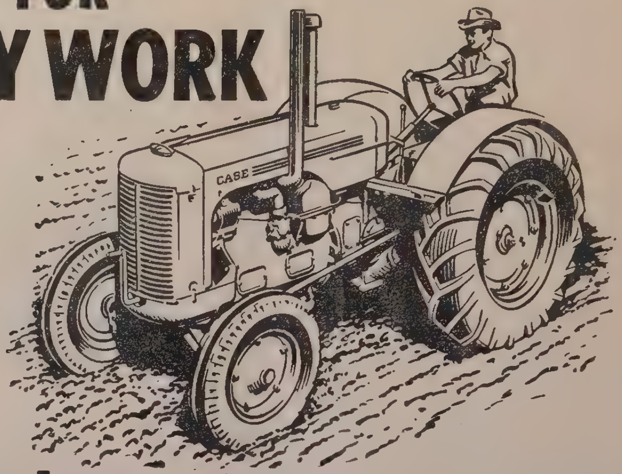

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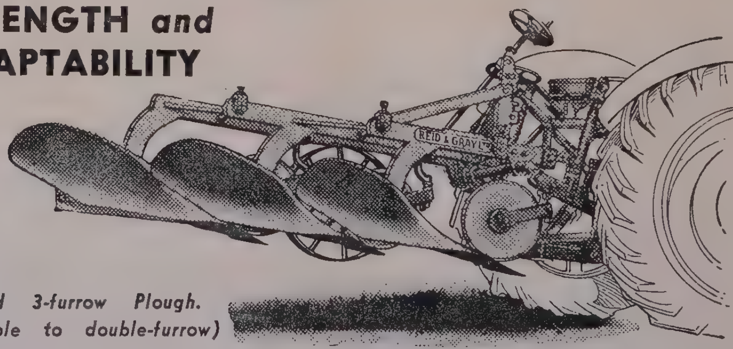

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F.24

Fertilisers

Even if a mulch has been dug into the border, an application of a complete fertiliser at this time of the year will be of great benefit to the plants and should be given at 2oz. to the square yard. Such a fertiliser may be made up of 3 parts by weight of blood and bone, 2 parts of superphosphate, and 1 part of sulphate of potash.

Garden Work for August

August may be considered the beginning of the new gardening year, and though it is too early to start sowing seeds anywhere except in glasshouses or frames in northern districts, it is the month for putting everything in readiness for smooth working when the busy spring season starts.

Flower seed should be bought now ready for September sowing. If this is left until later, the range of varieties narrows down, and though there will be supplies of the more common annuals, it is disappointing not to be able to try out some newer kinds and varieties.

Good seed should be bought, as the difference in cost is small compared with the difference in results. Care and attention cannot improve the plants obtained from poor seed. Poor plants take as much room in the garden as good ones and need every bit as much care and attention, yet the final result will remain indifferent.

Nemesias and pansies are two of the earliest sowings which can be made. Early sowing in boxes will give flowers in October and November. Preparation of seed boxes for the glasshouse is the same as for seed boxes used outside. A soil mixture containing 2 parts of soil, 1 part of peat, leafmould, or well-decayed compost, plus 1 part of sharp river sand is prepared by mixing the 3 ingredients thoroughly together. Raw compost in a seed box can do more harm than good. Each box should have cracks along the bottom to aid drainage and should have ½in. of rubble from sieved soil, scoria, or some other form of drainage beneath the soil mixture. Faulty drainage, combined with overwatering, is a common cause of failure in raising seed.

Soil in the boxes should be firm, and in particular the corners should be made firm and level with the remainder of the soil. If this firming and levelling are not carried out properly, the first time water is applied to the box the corners sink, leaving a hump in the centre of the box which is difficult to keep moist, and the corners themselves are kept too wet.

When the box is properly prepared it may be steeped by lowering it into a container of water, with the water no higher than the level of the soil; otherwise the topsoil floats off. Once dark patches show through, the box should be lifted out and left to drain. Seed may be sown next day. Alternatively, the prepared box may be watered overhead, care being taken not to cause flooding, which again is likely to disturb the topsoil. The box should be left to drain a few hours before sowing.

[*Green and Hahn*

Division of fibrous rooted herbaceous plants is best done by the use of two forks placed back to back.

Seed should be distributed evenly and not too thickly over the soil and covered its own depth with very fine soil. Poppy and antirrhinum seed, which are very fine, barely need covering. Lupin seed, which is larger, requires a deeper cover of soil.

Fresh seed should be used in preference to old seed, as it usually germinates more freely.

Seed boxes should be covered with glass and paper. The glass needs turning every day or the condensation which forms should be wiped off. Once germination occurs the paper should be removed, and the glass soon after; otherwise the seedlings become spindly and drawn.

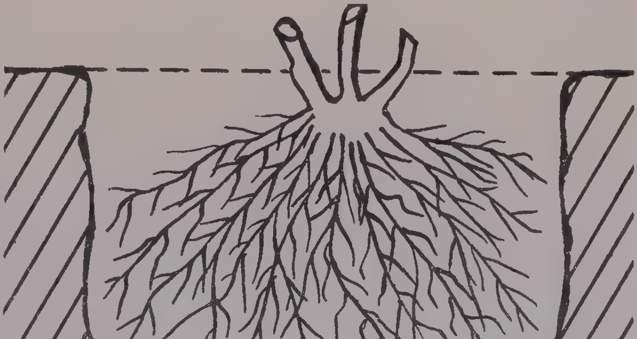
Watering should be carried out sparingly and with a fine rose on the watering can. Excess moisture, either on the foliage or in the soil in humid weather particularly, or where seedlings are very thickly sown, is likely to be a factor contributing to an attack of damping off, a fungous disease which is apt to cause havoc in seed boxes under these conditions.

Prevention by ensuring that the box is well prepared, with good drainage and thinly sown seeds, is half the battle. Where damping off does occur healthy seedlings should be pricked out immediately into fresh soil. A full description of raising plants from seed in boxes is given in the June 1952 issue of the "Journal".

Seed sowing outdoors direct into the soil must be delayed until soil temperature rises and the soil dries out more. For germination it is essential that air, moisture, and temperature conditions are favourable. While the soil is cold and wet, even if the seed does germinate, the adverse conditions may kill or weaken the roots, causing the plants to die or stand still. Once the soil has warmed up not only should the germination percentage be greater, but the resultant plants should be more vigorous.

Gladioli

In warmer northern districts the first planting of gladioli may be made for early flowers. Early plantings require approximately 90 days from planting to flowering. Later plantings may take less. The variety also has some effect on the time taken to flower. Gladioli prefer a good, rich, well-worked soil with freedom from root competition, and in exposed positions particularly it is just as well to put the stakes in during planting, so that they are there when required.



Fibrous rooted herbaceous perennial being planted. Note the depth it is placed and how the roots are well spread out.

Attention to pruning, manuring, and mulching of roses contributes much toward the production of good blooms on sturdy stems.

Planting depths vary from 4in. to 8in., depending on soil types; in lighter soils deeper planting is more satisfactory. As each planting hole is opened up with a trowel a handful of sand may be thrown in and the corm set on that. The corms most likely to give a good flower stem are those which are plump and thick through the centre. Cormlets may be sown now, about 1½in. deep, to gain the benefit of a long growing season.

Roses

The pruning of bush and climbing roses is carried out now and should be completed by the end of this month.

Pruning of bush roses is a straightforward job and consists of cutting out all dead and diseased material, all spindly and weak growth, and all spent flowering material. Once all this material is removed it is possible to remove crossing branches and to prune to keep the centre of the bush open. This is best carried out by cutting to a bud which points outward. Strong young growths should be retained in preference to older wood.

Climbing roses are pruned by the cutting out of weak or diseased growths and the shortening of the side shoots which have flowered to within two or three buds of their base. Strong young unflowered shoots only need their tips cut back slightly.

Sharp secateurs should be used to ensure that each cut is clean and does not tear or damage the bark. All cuts should be made just above the position where a bud arises. Where buds are dormant or not pronounced the scar showing where a leaf has fallen gives a useful indication of the bud position.

All prunings should be gathered and burnt. Not only are prunings extremely unpleasant to discover while weeding around the rose bed is being done, but they harbour fungous diseases and sometimes insect pests.

After pruning is done, the rose bed can be lightly forked, and as roses are surface rooted, the working must be shallow to avoid damaging them. A mulch of farmyard manure, or where this is unobtainable a dressing of 4oz. of blood and bone plus 2oz. of superphosphate may be given before mulching with compost or lawn clippings. This mulch will need renewing at intervals throughout the growing season. Whichever mulching material is used it should be distributed to cover the full extent of each plant's roots and should not be allowed to touch the trunk.

Immediately after pruning and before the new growth breaks a spraying of Bordeaux mixture should be given at 6½oz. of bluestone and 5¼oz. of hydrated lime to 4 gallons of water against the carry-over of fungous diseases, particularly black spot. A Bordeaux spray of this strength can be used only while there is no foliage on the bush. For later use when the bush is in leaf the strength of 4oz. of bluestone and 5oz. of hydrated lime to 4 gallons of water may be used as a protection against black spot. Where rust is troublesome a change should be made to lime sulphur in summer, one-fifth pint to 4 gallons of water.

Where rose scale is present on older rose wood a summer oil spray at the strength of 1 pint to 4 gallons of water may be applied, or the oil may be incorporated in the first Bordeaux spray. For climbing roses, where the spray cannot be applied to give an effective coverage on the side nearest the wall or support, when pruning is being done the canes can be untied and scrubbed with an emulsion of summer oil, 1 pint to 4 gallons of water.

Sweet Peas

Seeds of sweet peas may be sown in boxes in frames or glasshouses for later planting out. As sweet peas do best on firm soil, the bed they are to occupy can be prepared now. It should be thoroughly worked and well enriched with decayed farmyard manure or compost added to the bottom spit. Sweet peas are gross feeders and like to get their roots well down. They do not like loose soil, so that preparations made in advance will allow the soil to consolidate before planting. A light dressing of lime may be applied after planting out.

As slugs are particularly attracted to young sweet peas, it may be necessary to use some slug bait around them. Metaldehyde tablets crushed and mixed with bran slightly moistened with molasses provide a satisfactory control. Small heaps should be set out and protected from rain by partially covering them with chips of wood or pieces of broken flower pots.

Stakes or wire netting should be in position before the seed is sown. Soaking of seed may be done, though it is not particularly beneficial. If the seed is soaked, **it must be sown immediately into damp ground;** otherwise the seed which has been started into growth by the water will be dried out and killed.

Shelter

In many home gardens lack of adequate shelter is one of the principal factors limiting the garden display. Plants cannot do their best when constantly being buffeted by drying winds. Roots worked loose in the soil soon dry out. New growth on shrubs is scorched and shrivelled and even older leaves develop a puckered look.

It is still not too late to put in a hedge to form a breakwind. For coastal areas *Corokia cotoneaster, Coprosma baueri* (taupata), or flax will withstand salt wind. In other districts quick temporary shelter may be had by using tree lucerne or *Albizzia lophantha.*

The albizzia and tree lucerne may be sown from seed next month. For best results seed should be soaked in hot water and drilled into damp soil. With tree lucerne better results may be gained if soil collected from around other established tree lucernes is included in the drill. Albizzia is frost tender, so that its use is restricted to Auckland and the coastal areas of the North Island.

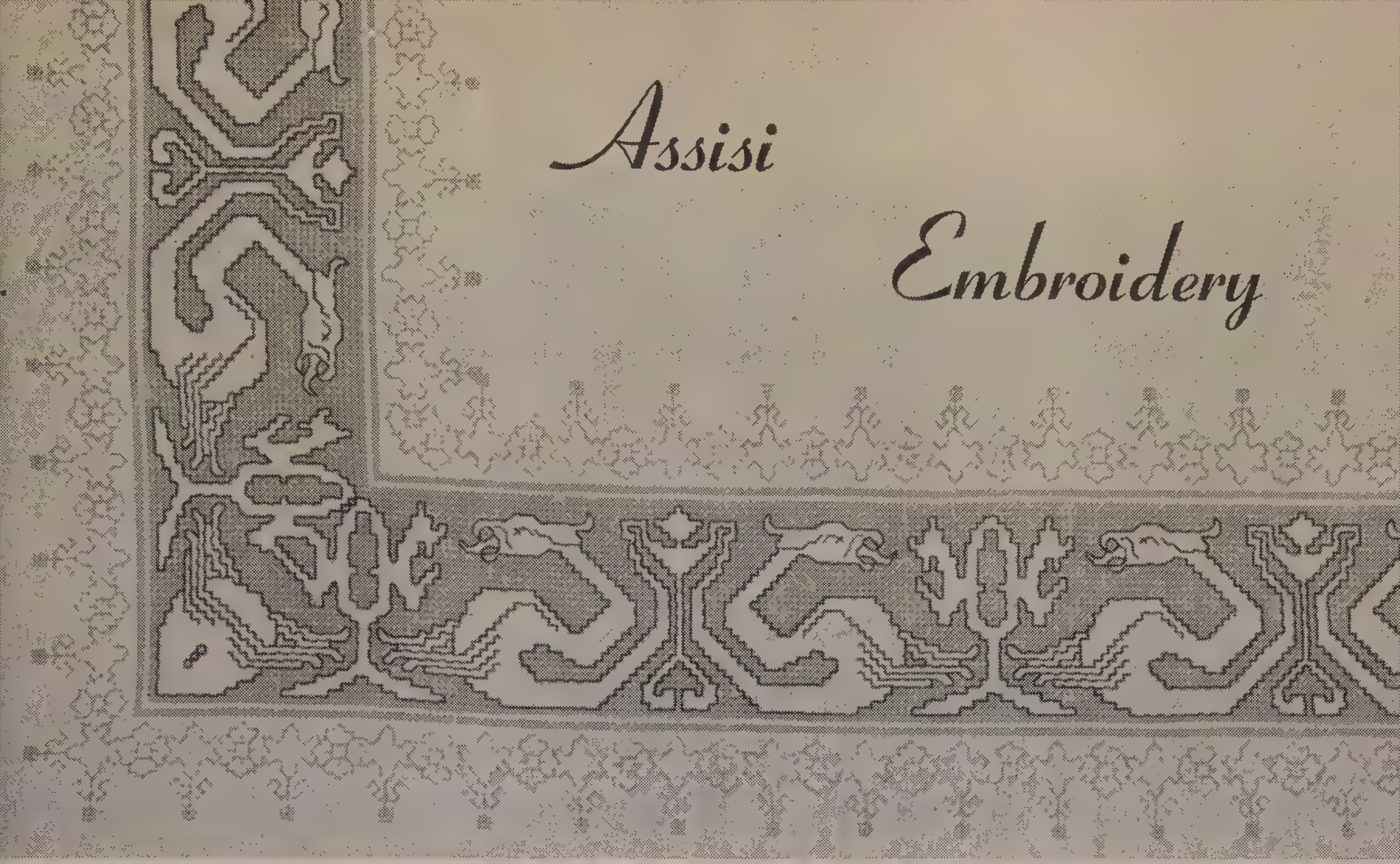
Where these two hedges are trimmed from early days they create most satisfactory temporary shelter. With age, however, they open out, and borer attacks kill some of the branches, so that planting of a permanent hedge species should not be delayed. Where space is not a consideration *Buddleia salvifolia* makes a useful rough hedge. It stands coastal conditions and poor soil and will grow to 15ft. or 20ft. in 4 years. Cuttings of buddleia may be planted now, and in a year they should be up to 4ft. high. Cuttings should be made of vigorous, firm wood of last season's growth and each one trimmed with a straight cut below a node, which is the position where a leaf bud arises. Depending on the distance between nodes, each cutting should be 6in. to 8in. long.

Planting of the permanent hedge should not be a haphazard job. A good hedge takes years to develop and time spent on planting and maintenance ensures proper growth. A well-grown hedge takes a few years to become a feature of the home surroundings. The hedge chosen should be one known to grow satisfactorily in the district and it should be suitable for the purpose. *Abelia chinensis, Escallonia exoniensis,* privet (*Ligustrum ovalifolium*), and *Lonicera nitida* can all be trimmed to make neat hedges which do not become too wide and which can be kept at any height required. *Pittosporum crassifolium* (karo) is a suitable coastal hedge, but is inclined to open out at the base. Tasmanian ngaio (*Myoporum serratum*) is a quick-growing shrub also suitable for the coast, but the best shrubs to be used as a trimmed hedge in a seaside garden are taupata (*Coprosma baueri*) and *Corokia cotoneaster.* Around Auckland and frost-free districts *Tecoma capensis* makes a most satisfactory hedge; if it is to be grown to any height, it requires the support of a wire fence.

Large hedge species such as acmena (*Eugenia smithi*), *Chamaecyparis lawsoniana,* and *Cupressus macrocarpa* may be suitable for farm and orchard shelter, but grow far too big for general use in small gardens.

All photographs on page 88 except that of helianthus are by Douglas Elliott.

Assisi Embroidery



MANY exquisite forms of embroidery are built up from the simplest of stitches, and Assisi embroidery, worked only in cross stitch and running stitch, is a charming example. The character of Assisi embroidery, so named because it was originally the work of the nuns of the little Italian village immortalised by St. Francis, has persisted in much the same form up to the present. A general description of Assisi embroidery and the patterns from which to work a border cloth are described in this article by Helen Paine, formerly Field Officer in Rural Sociology, Department of Agriculture, Wellington.

THE earliest examples of Assisi embroidery, many depicting the legends of St. Francis, are found on fine ecclesiastical linens. The work is extremely delicate.

Later examples show its development as a pleasant embroidery worked on coarser cloth in bolder patterns, but still with the same simple forms.

Traditionally Assisi embroidery is worked in scarlet and powder blue on the palest shade of ivory linen. The design is outlined and the background filled in in the chosen colour, emphasising the design, which is left in plain linen.

The effectiveness of the embroidery depends largely on the simplicity of the design, for though the workmanship requires patience, it does not require practised skill, as the stitches are always made by counting threads. For this reason the beginner should start work on a fairly coarse piece of linen.

Materials

An ivory or cream linen is still considered the most effective background for Assisi embroidery. The work is most striking on fine or medium fine cloth, though it is also attractive on the coarser linens. It is important that the cloth used should be woven from strands of equal thickness in the warp and weft.

Mercerised embroidery cottons or stranded cottons can both be used for the work. Two colours are necessary, one for the outline and one to fill in the background. Scarlet and pale blue are very effective, but many combinations of black outline and another background colour are equally attractive. Red and black is particularly effective, and blue, orange, yellow, or green and black are all pleasing.

A blunt crewel needle should be used for the embroidery.

The Design

After practice and experience it is possible to work out designs for Assisi embroidery, but for the beginner designs taken or adapted from the traditional patterns are easier to work with.

Any book of embroidery which describes Assisi work will probably provide graphed charts of suggested designs. It is wise to start on something small (a tray cloth or a trolley cloth), embroidering only the ends. When that is complete a larger cloth with a border all round it could be attempted.

Assisi embroidery makes an effective border for hessian curtains, and an attractive design can be worked out for a linen cushion as well as for the more usual cloths.

The chart given with this article is for the more ambitious works and shows how to adapt a design to form the corner of a cloth. A portion of this design could, however, be used for the two ends of a small tray cloth or any of the other suggestions.

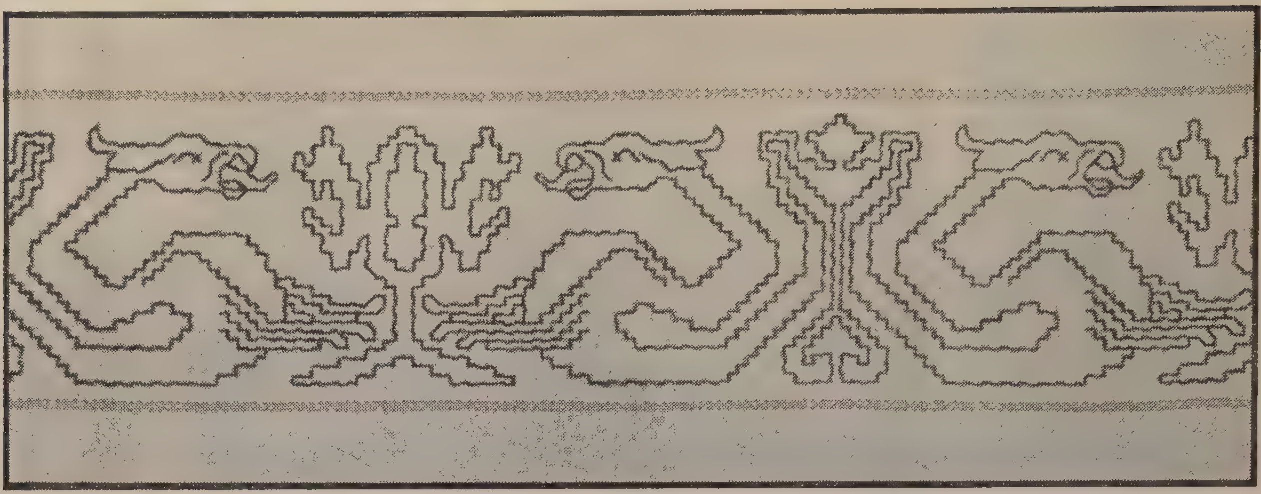
Preparation of Material

Cut the material approximately to size, allowing generously for the hem. Overcast any raw edges. Starting at any corner, mark the position of the edge to the embroidery.

Cross stitch is the main stitch used in Assisi embroidery, and it is worked over three or four stitches according to the fineness of the cloth. The cross stitches which form the background should show up as a solid mass of colour and should not be open. Therefore, when coarser material is used the cross stitch should be worked over a unit of 3 strands, but with finer material 4 strands can be used.

Working the Material

When the unit has been decided on, a tacking thread is run from the corner straight across a thread of material over one unit and under the



The motifs are outlined in running stitch with a dark thread.

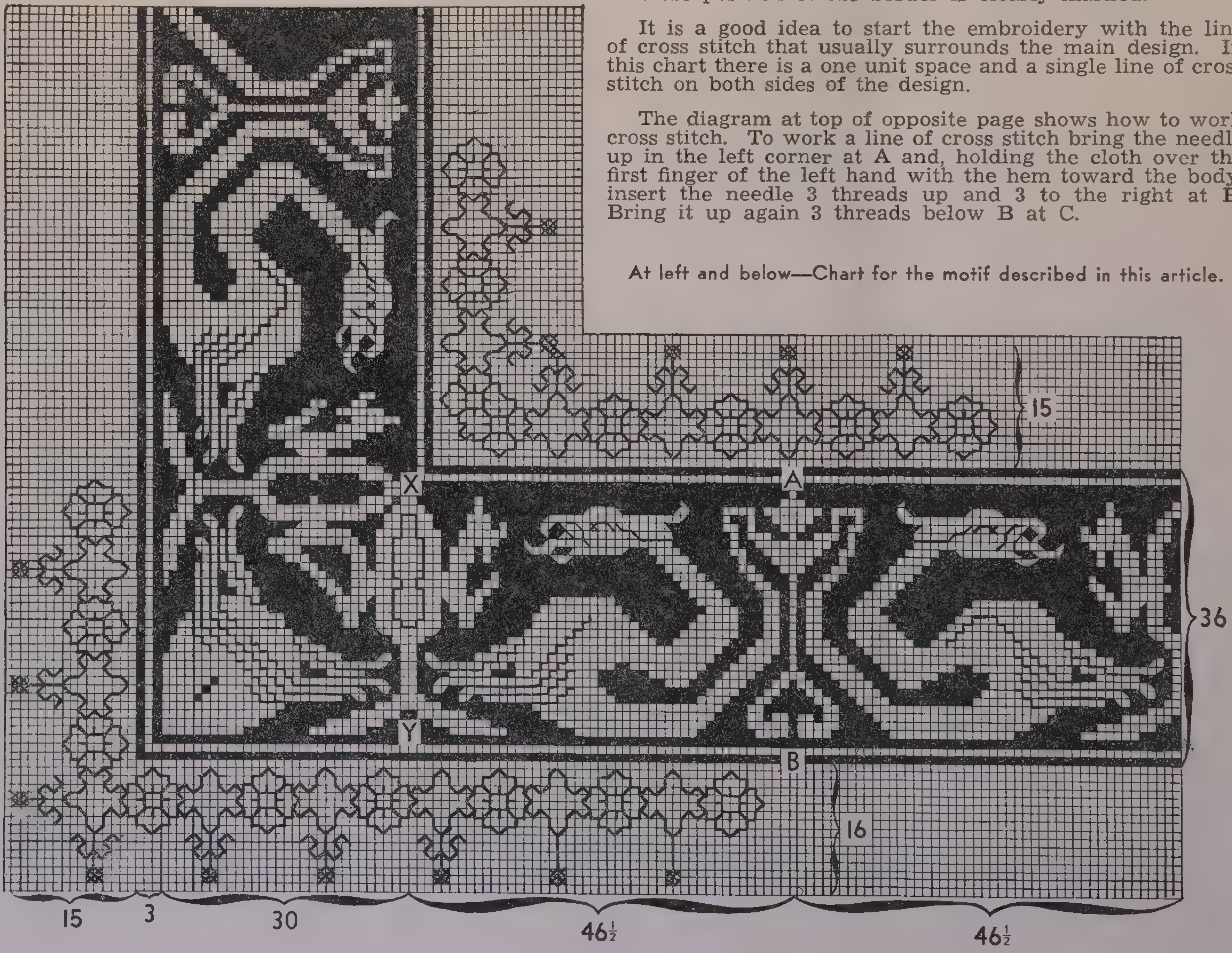
next; for instance, over 3 strands and under 3 strands. This should be done in two directions. This tacking thread forms a guide from which the pattern is worked. The chart is then worked from, each square in the graph being interpreted as one unit. It will be seen that the border stitch in the chart illustrated on this page occupies 15 units on either side of the main design, which takes up 36, so that the whole border occupies 15 + 15 + 36 = 66 units.

It is not necessary, but it may be a help to beginners, to make another line of tacking 66 units from the first so that the position of the border is clearly marked.

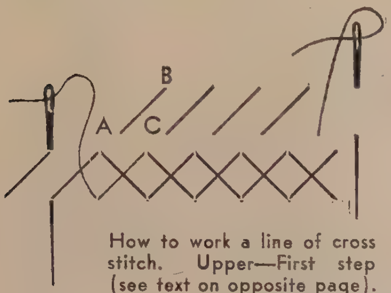
It is a good idea to start the embroidery with the line of cross stitch that usually surrounds the main design. In this chart there is a one unit space and a single line of cross stitch on both sides of the design.

The diagram at top of opposite page shows how to work cross stitch. To work a line of cross stitch bring the needle up in the left corner at A and, holding the cloth over the first finger of the left hand with the hem toward the body, insert the needle 3 threads up and 3 to the right at B. Bring it up again 3 threads below B at C.

At left and below—Chart for the motif described in this article.



Insert again 3 threads up and 3 along and repeat the stitch to the end of the row, forming a line of starting stitches. To complete the crosses turn the material around so that it is held with the hem away from the body and come back along the line of stitches in the same way as before. It is not necessary to count threads on the second line, but care must be taken to see that the needle goes between the threads and does not split them.



How to work a line of cross stitch. Upper—First step (see text on opposite page). Lower—Second step.

Whenever a cross stitch is made the upper threads must be parallel to preserve the uniformity of the work. The bottom threads in the work illustrated all run from bottom left to top right of a square.

The two lines of cross stitch should be worked around the cloth to form the border of the design, but it is necessary first to calculate where the corners will come so that the design fits exactly into the border space.

This must be done by counting the number of units in the side of the cloth and dividing them into the number necessary for the design. For instance, in the chart illustrated the actual corner occupies 48 units up to the line XY. Then one motif of the design (from XY to AB) occupies $46\frac{1}{2}$ units. As this is repeated back to front, the whole design occupies 93 units. Therefore to find the number of lines the design will be repeated.

Count the number of units in one side of the cloth. Subtract from this number twice the number of units occupied by the corner motif (one for each corner) and divide the remainder by the number of units in the motif. For example, if there were 569 units in one side of the cloth, 569 — 2 × 48 (two corners), that is,

569 — 96 = 473
473 ÷ 93 = 5 + 8 over.

Therefore, the motif will be repeated 5 times and the whole border from corner to corner will occupy

93 × 5 + 2 × 48 units, that is,
465 + 96 = 561 units.

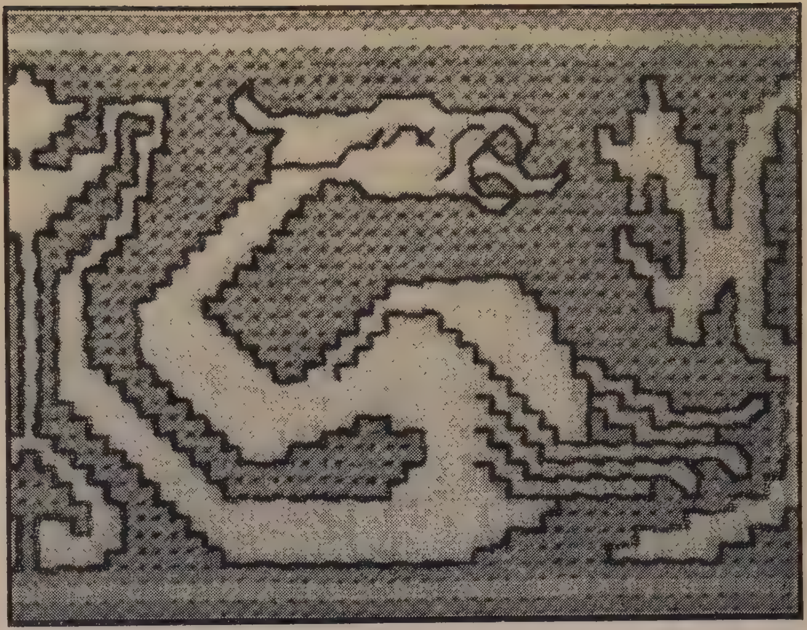
The border all round the cloth can now be outlined in a tacking stitch.

The first step in the actual embroidery is to work the two lines of cross stitch which surround the main dragon design.

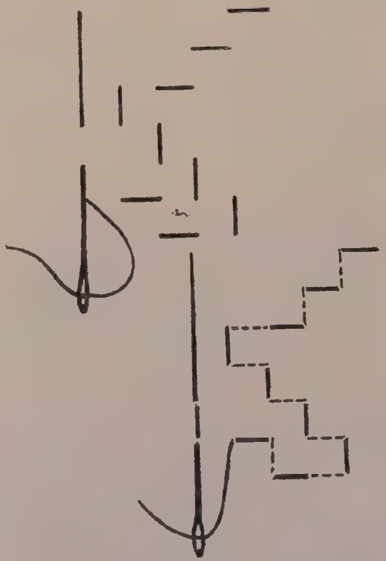
Leaving 15 units at the edge for the border design, begin a line of cross stitch, stopping 15 units from the corner on the opposite side and then working another side at right angles to the first. Complete the outer line of cross stitch around the cloth.

Leaving 34 units between the lines of cross stitch, work an inner square around the cloth.

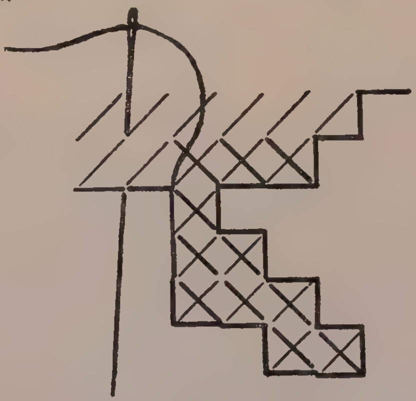
Working from the chart and using a running stitch, outline the dragon motifs in the dark thread (see diagrams above and illustration at top of opposite page.



The background is filled in with cross stitch, which shows the white design in bold relief.



The two stages of working running stitch.



Filling in the background.

Beginning at point A in diagram, carry the needle and thread over 3 threads and under 3 threads, following the design in the chart. A second line of running stitch fills in the alternate spaces and makes a continuous outline.

The outline formed has the appearance of back stitch, but is actually two rows of running stitch, the second going under where the first goes over.

When the outline has been completed the linen round the pattern is filled in with cross stitch, the first half of each stitch being made in the same direction. To achieve this it is easiest to work in rows, making all the first stitches of several rows, and then completing the crosses by going back over the work (see diagram and illustration above).

The two stages of Assisi embroidery, the outline and the filling stitch, have now been described.

When the design is completed a running stitch border is repeated on the inside and outside of the work. This light tracing embroidery throws up in delightful contrast the solidity of the main design. It is worked from the chart in the same way as the outline of the motif. Two lines of running stitch are worked, going alternately under and over 3 threads of material, to form a continuous line.

A small block of four cross stitches completes the border edge.

The hem of the cloth is then turned in to the edge of the embroidery and caught by a simple hem stitch.

The cloth is then pressed on the wrong side with a damp cloth and is ready for use.

Woman's Ankle Socks in Diamond Pattern

FOR the woman's ankle socks in diamond pattern illustrated, a small ball of wool should be used for each diamond and the wools should always be twisted at the back of the work when colours are changed to avoid a gap.

MATERIALS: 1oz. of 3-ply wool in main colour (grey), ½oz. of 3-ply wool in dark colour (maroon), ½oz. of 3-ply wool in light colour (yellow). Two No. 13 knitting needles.

Measurements: Leg to ankle, 4in.; length of foot, 9½in. Tension: 9 st. to 1in.

Abbreviations: K. knit, p. purl, st. stitch(es), rep. repeat, cont. continue, patt. pattern, M. main, Dk. dark, Lt. light, col. colour, dec. decrease, tog. together, sl. slip, p.s.s.o. pass slipped stitch over, st.st. stocking stitch (1 row k., 1 row p.).

With No. 13 needles and Dk. wool cast on 60 st. and work 1in. in k. 1, p. 1 rib, inc. 1 st. at end of last row. (61 st.). Cont. in diamond patt., working from the chart as follows: Odd numbered rows are k. rows and are worked from right to left, even numbered rows are p. rows and are worked from left to right, thus:—

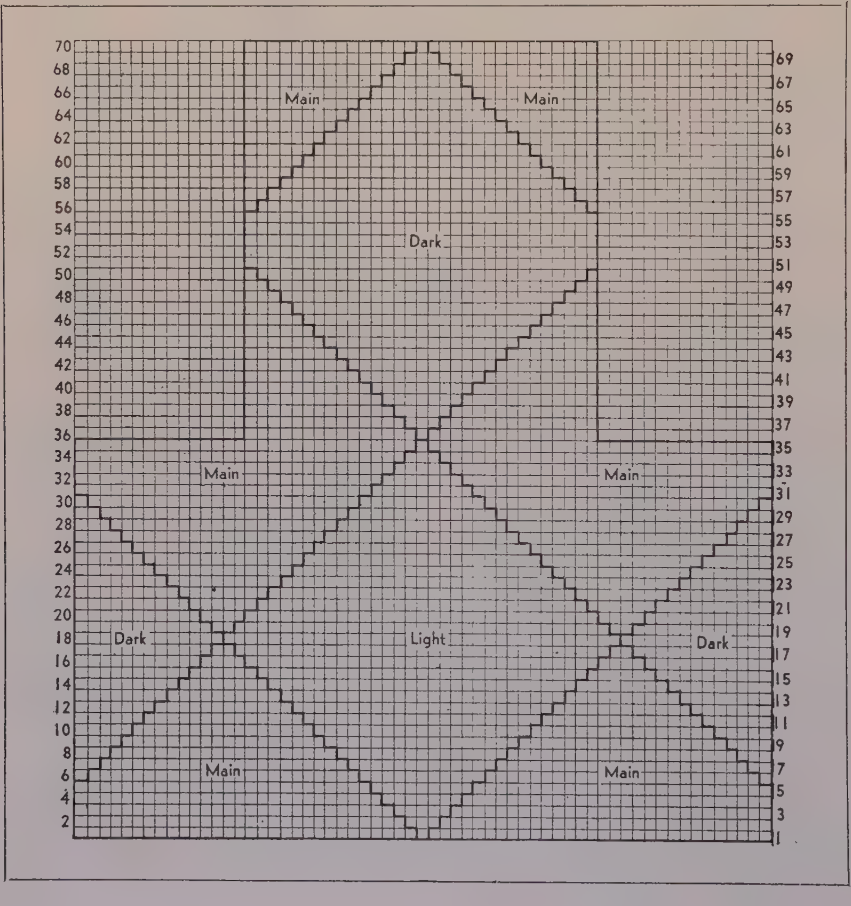
First row: K. 30 M., 1 Lt., 30 M. Second row: P. 29 M., 3 Lt., 29 M. Cont. in this way to the end of the thirty-fourth row.

Shape for Instep

Next row: K. 30 M., 1 Lt., 15 M., turn. Next row: P. 15 M., 1 Dk., 15 M. Cont. working from the chart to the end of the seventieth row. Next row: K. 15 M., 1 Lt., 15 M. Now cont. working from the chart repeating rows 37 to 70 inclusive, but substituting Lt. wool for Dk. wool for the centre diamond and working p. rows on chart as k. rows and k. rows on chart as p. rows. Change to M. wool and work 3 rows in st.st., beginning and ending with a p. row and dec. 1 st. at end of last row.

Shape for Toe (Using M. Wool)

Next row: K. 1, sl. 1, k. 1, p.s.s.o., k. to last 3 st., k. 2 tog., k. 1. Next row: P. to end. Rep. these 2 rows until 10 st. remain. Leave st. on a spare needle. Sl. the two sets of heel st. on to one needle with side edges to centre to form back seam. With M. wool and with right side of work facing proceed as follows:—



First row: * Sl. 1, k. 1. Rep. from * to end. Second row: P. to end. Rep. these 2 rows 16 times.

Turning the Heel

First row: K. 18, k. 2 tog., turn. Second row: P. 7, p. 2 tog., turn. Third row: K. 8, k. 2 tog., turn. Fourth row: P. 9, p. 2 tog., turn. Fifth row: K. across st. of previous row, k. 2 tog., turn. Sixth row: P. across st. of previous row, p. 2 tog., turn. Rep. last 2 rows until all side st. are worked on to one needle, ending with a p. row. (18 st.). Next row: K. to end, then k. up 20 st. along side edge of heel flap. Next row: P. to end, then pick up and p. 20 st. along other side edge of heel flap.

Shaping the Instep

Next row: K. 1, sl. 1, k. 1, p.s.s.o., k. 2 tog., k. 1. Next row: P. to end. Rep. last 2 rows until 32 st. remain. Cont. straight in st.st. until work measures same as top part of foot to beginning of toe shaping, ending with a p. row and dec. 1 st. both ends of last row. (30st.)

Shape toe as given for top part of foot, then graft the two sets of st. neatly together.

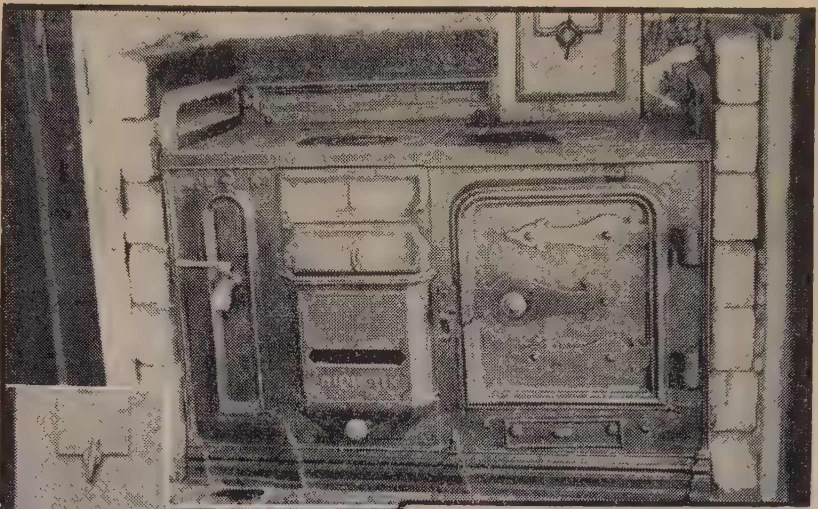
Press work lightly with hot iron over damp cloth.

Join foot and leg seams neatly. Press seams.

Selection and Management of Cookers

A PROBLEM which confronts many housewives is how to select a cooker which will meet all requirements, be easy to handle, and provide maximum fuel efficiency. Many factors must be considered, and this article by Eleanor Couston, Field Officer in Rural Sociology, Department of Agriculture, Christchurch, explains the major differences in the performances of available stoves, desirable features, and details of management.

CASUAL questioning of a housewife generally results in an expression of satisfaction with the stove she possesses, whatever its type, thus indicating that she has learnt to manage it satisfactorily. There are, however, those who are building new homes, others whose requirements have altered, or those whose stoves are worn out and who look for guidance in deciding what to buy.



Upper right—After years of faithful service this range must be replaced and the question arises, "Which type of cooker will best serve the needs of the household?" Above—A possible choice is a streamlined, enamelled range which will burn wood or coal or which can be converted to an oil burner. A thermometer replaces the round plate shown on the oven door.

Many new features have been introduced into the newer models of cookers, and though each type has certain limitations, it should be possible to find one which will satisfy individual requirements. For good results it is necessary to see that the cooker is installed correctly, that it is placed in the most convenient position in the kitchen for cooking and serving, and that it has adequate lighting both day and night. These precautions, with an understanding of the way the cooker functions, intelligent handling, and a careful study of manufacturer's instructions should lead to high-standard cookery and uniform results.

Availability and Cost of Fuel

The selection of a cooker, particularly in rural areas, will be influenced greatly by the availability of fuel. Many districts in New Zealand do not have electric power, and a larger area is not supplied with gas. Probably for some years there will be restrictions in the use of electricity, and this may affect a choice if cooking facilities are essential at any hour of the day.

Where electricity or gas is not available the choice is limited to solid-fuel, oil-burning, or kerosene cookers. The heavily insulated heat-storage cookers, which have many favourable features, require smokeless fuels such as anthracite or coke. In New Zealand anthracite is available in very limited supplies, and coke varies both in supply and in quality. Before such a cooker is installed it is wise to make certain that regular supplies of suitable fuel are available.

The semi-heat-storage cookers will burn any solid fuel and are so insulated and draught controlled as to give high fuel efficiency.

Most coal ranges will burn wood or coal, but once again the availability of the fuel must be considered and an evaluation made of the labour and costs involved in obtaining it.

A careful study of the fuel supply in the district and a comparison of costs should be made as a preliminary step in the choice of a cooker. Where labour saving is the primary consideration a gas or electric cooker supplemented by some form of water and space heating may be the wisest choice, whereas when economical running is desired the heavily insulated heat-storage type of cooker may prove better.

Also to be considered are the cost of maintenance and the location of the firm supplying the cooker. Correct installation is important for the efficient running of many types of stoves, and it is best to buy from firms which employ experts fully equipped to install their cookers correctly and to maintain them in good order.

Requirements

The next step is to assess the requirements which the cooker will have to meet and the following factors should be considered:—

Is the cooker for a rural home or an urban home?

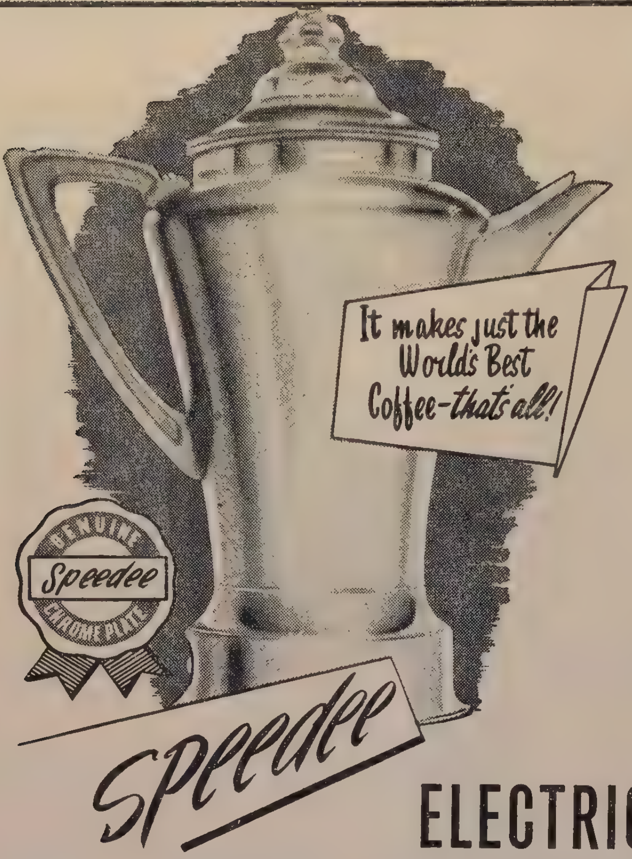
Is it to be placed in a small kitchenette or a large kitchen-dining room?

What is the size of the family and are there young children or only adults?

Are there seasonal demands to be met such as cooking for extra men during shearing and harvesting?

Will the oven be large enough for roasting and baking, and the top space for boiling and frying?

Is there provision for grilling and toasting?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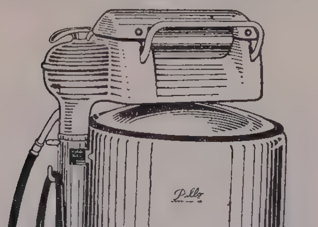

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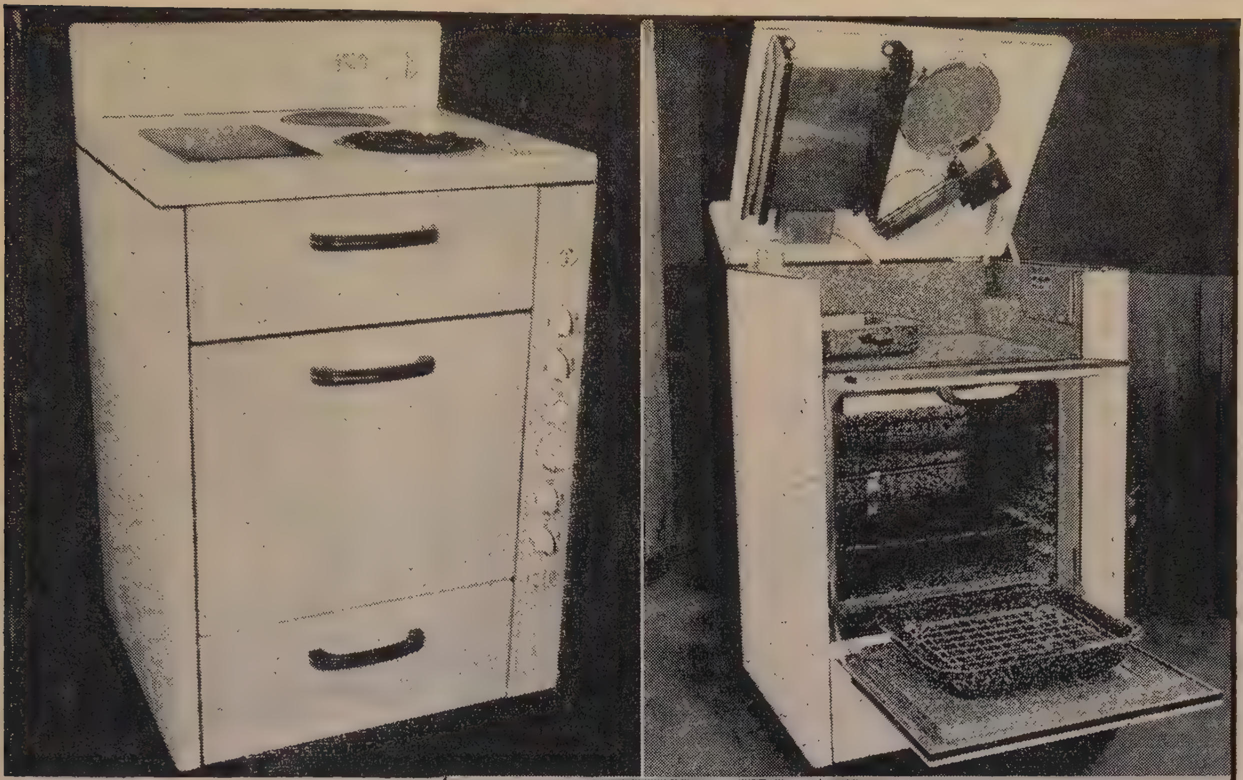

Above and upper right—A New Zealand model electric cooker with new features such as a minute minder, a top plate which can be opened, and a separately heated warming compartment. At right—The reflector plate under the fast-heating tubular element can be removed for easy cleaning.

Is there some means of warming plates?

Will the cooker heat quickly or is it continuous burning? Can the temperature be regulated?

Will the cooker heat water or will subsidiary water heating arrangements be necessary?

Will the cooker warm the room or is a cool room more desirable?

Will the cooker require frequent stoking and is it easily cleaned?

Has it a good appearance?

Will the initial outlay be justified by fuel economy?

Consideration of these factors will give the purchaser a basis for comparing the different types of stoves and a means of determining which will measure up to the needs of the household.

Electric Cookers

Cooking by electricity is clean and labour saving and many modern electric cookers have thermostatic oven control and "Simmerstat" control of one or more of the hot plates. Such control makes regulation of cooking temperatures very easy and also effects a considerable saving in current. In future it may be possible to have time control as well as temperature control, when a device known as an electronic eye will actually measure the temperature of the food and maintain the correct temperature by switching the current on and off. Special features which appear on some overseas models are minute clocks which are particularly useful in pressure cooking, and deep-well containers which can be used for deep-fat frying, steaming, boiling, braising, and stewing; in some cookers the oven and the top plate are separate units which can be placed where they will be most convenient.

However, the main features to look for in the stoves which are available are their soundness of construction, adequacy of size, and efficiency of insulation; it is also important that the oven door should open the correct way for lighting. A good electric cooker should have welded body construction and be finished in a durable synthetic or porcelain enamel. It should be fitted with a splash-back, preferably in one piece with the stove top for easy cleaning. The oven should be fully insulated on all sides and have easy-sliding, lock-stop shelves. Most electric stoves made in New Zealand have top and bottom open-coil oven heating, and imported models have side heating. Though either is satisfactory, slightly different cooking techniques must be used. With top and bottom heating the top element is used mainly for pre-heating the oven and should be turned off before the food is put in unless extra top heat is required, as for browning a breadcrumb topping. Otherwise food will be burnt. With side heating elements the top part of the oven will still be hotter than the lower part, but there is less likelihood of burning. An oven large enough to hold two sandwich tins on one shelf with sufficient space for free circulation of heat is desirable where any large quantity of baking is done.

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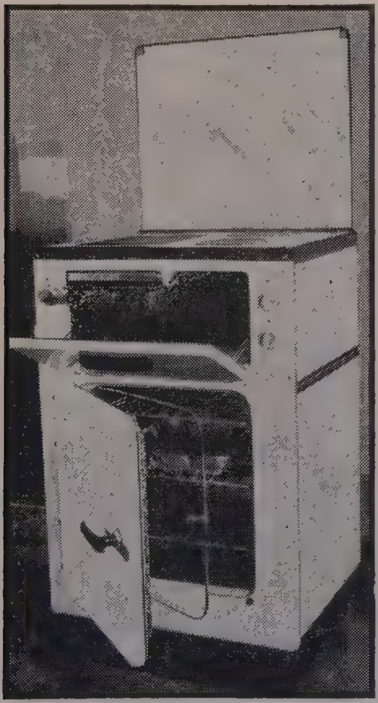
Most cookers are fitted with three surface units of different sizes to fit corresponding sizes of saucepans and prevent waste heat. Some have two circular plates and one rectangular plate, an arrangement usually seen when the griller is in a separate compartment. One unit is generally fast-heating, and all units can be regulated to high, medium, or low. Boiling plates may be either the solid or tubular type. The tubular plates facilitate quick heating and do not require ground-base utensils, but will not retain their heat as long as the solid type. Some cookers have double spiral units, in which half the element may be turned off, thus conserving fuel when a small saucepan is being used. In some models the hob surrounding the hot plates can be lifted for easy cleaning.

Many of the newer models have counterbalanced, drop-front doors which serve as rests for baking tins when food is being basted. Some have a side-opening door and are fitted with an inner door of heat-resistant glass which enables the cook to inspect her products without causing a draught or loss of oven temperature. When the outer door is opened a switch turns on a light inside the oven. Choice of door is a matter of personal preference, but if a side-opening door is chosen, it should be open so that light can make the oven clearly visible.

Some stoves have separate grilling compartments, with space which can be used for warming plates or keeping food warm. In some stoves the top oven element is used for grilling, but this restricts the use of the oven while grilling is in progress. Some stoves have a separate compartment for plate warming or for storing spare trays when the stove is not being used.



An English model electric cooker with a heat-resistant glass inner door, a separate grilling and plate warming compartment, thermostat and "Simmerstat" control switches, and a splash-back which can be closed.

As with all stoves the cooking surfaces should be level to ensure maximum conductivity of heat and to prevent saucepans tipping over.

Earlier models frequently had side ovens which eliminated stooping, but to conserve space most are now made as upright, console types.

Switch control may be on the side, front, or splash-back, the advantage of the last-named being that the switches are inaccessible to children and no stooping is necessary to reach them. Also when the oven is thermostatically controlled the indicator light on the splash-back can be seen easily.

All ovens should be fitted with a vent to allow steam to escape, and an innovation is to place this vent to the rear of the top surface of the stove to prevent marking of the wall at the back of the stove by the escaping steam.

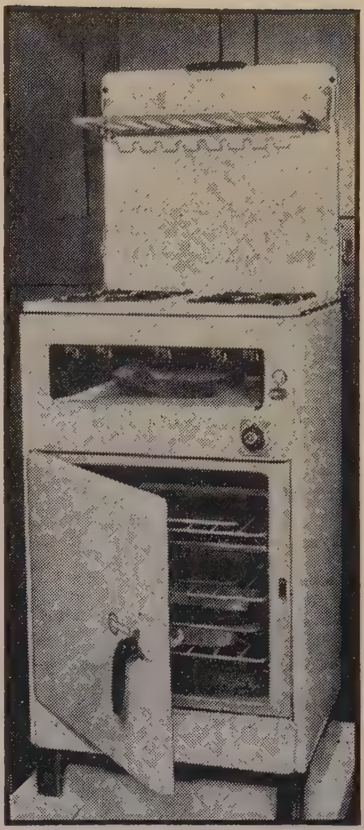
A point is useful for plugging in appliances such as electric jugs, but when a jug or kettle is used it should not be placed directly on the stove, as escaping water may damage the elements. A drip tray should always be provided with the stove to catch spilt food.

An electric stove does not incorporate any means of water heating, nor does it contribute appreciably to the heating of the kitchen. Water heating may be by electric immersion heater, by gas, or by destructor. A destructor is useful for garbage disposal as well as for heating the water. Where space heating is desired a slow-combustion space heater gives high fuel efficiency, and some types are available which will warm the room and heat the water simultaneously. If the hot water cylinder is a long way from the most frequently used tap, for example that over the sink, a separate instantaneous water heater will be a saving.

Gas Cookers

Gas provides a clean and quick means of cooking. More people cook by gas in Great Britain than by any other means. As the flame is visible, the amount of heat can be regulated easily. A regulator on the side of the oven controls the oven temperature, and some models are also fitted with a device for thermostatic control. The burners of modern gas cookers are adjustable so that lighting-back does not occur when the flame is turned low. Most models are of the console type and are designed to fit in with other kitchen bench surfaces. They are streamlined and have a porcelain-enamel finish which assists easy cleaning. The majority have side-opening oven doors and for this reason should be placed where the light will fall in the right direction. Some overseas models have heat-resistant glass doors which enable the cooking food to be watched.

Improvements have been introduced and new models have removable hot plate pan supports which can be lifted out for easy cleaning. The burners are made of cast iron, and these too are removable and should be kept clean to allow a free passage of gas. A drip tray with a raised edge is placed under the burners to catch spilt food. The size of the top burners varies and some burners have two mixing tubes, one for the outer circle of the burner and the other for the inner circle for simmering purposes. This provides greater fuel economy than when food is simmered over a turned-down flame.



This modern gas cooker has a closable top with a plate rack attached. The spring-sealed door conserves heat and a regulator controls oven temperatures. The hot plate pan supports can be removed for easy cleaning.

The griller can also be used for toasting. Some models have a plate rack, attached to a splash-back arrangement, which can be folded down when the stove is not in use. Others have a separate warming oven for heating plates and keeping food hot.

An automatic gas lighter for the surface burners is a desirable accessory, and where the burners are at the back of the oven a flash-back method of lighting them is convenient. Some gas cookers have burners at the sides of the oven. Either arrangement is efficient, but sufficient space for circulation of hot air should always be left between dishes and the sides and back of the oven.

Modern gas cookers have a flue outlet at the bottom, an arrangement which gives greater fuel economy than where the outlet is at the top of the oven. They are also fitted with safety taps so that a tap cannot be turned on accidentally.

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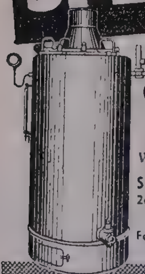

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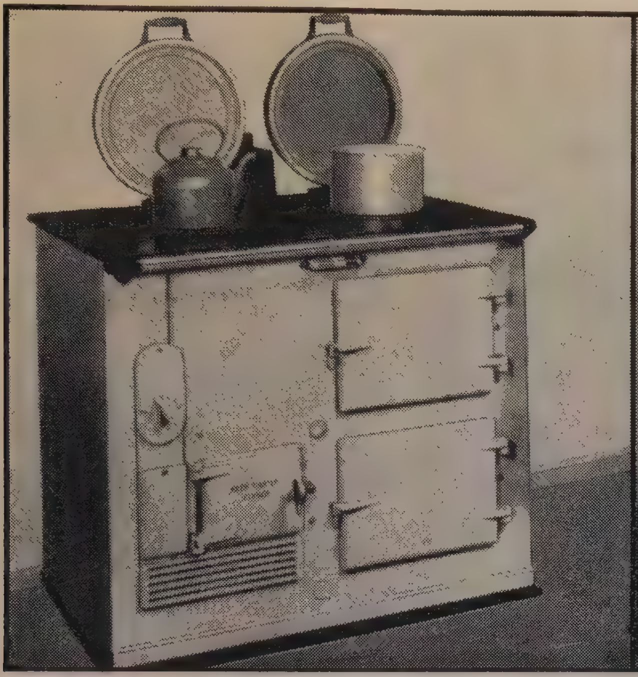


Below—A fully insulated heat-storage cooker which gives continuous burning and has roasting and simmering ovens. It is designed to burn either anthracite or coke, and a mercury-operated thermometer controls the speed at which the fire burns. Right—A type of semi-insulated heat-storage cooker which will burn any type of solid fuel and is continuous burning. It has a roasting oven and a warming oven and spin-wheel draught control.

A de luxe model which has recently appeared on the market has a general-purpose oven, a separately heated warming chamber, a storage drawer, and a griddle plate which can be used for cooking pikelets and drop scones or for dry frying. In this model the flues from the enclosed compartments are built in and the steam escapes forward through a vented splash-back, thus avoiding high wall temperatures and enabling the stove to be installed flush to the wall.

A final point to look for before purchasing a gas stove is to make sure it has flat top plates on which small pans will sit securely without tipping.

Gas ovens should be pre-heated for 10 to 15 minutes before food is cooked. The regulator is set 2 numbers above the number required for correct baking temperature. The food is then put in the oven and the regulator turned back to the correct number. As the temperature at the top of the oven is higher than at the bottom, foods requiring different baking temperatures may be cooked at the same time. The temperatures which can be obtained with the different regulator numbers are given in the table below.

A gas cooker contributes little heat to the kitchen and the same provision must be made for water heating as is required with an electric stove.

Solid-fuel Cookers

Coal Ranges

Many homes in town and rural areas are satisfactorily serviced by coal ranges. The modern enamelled type has distinct advantages over the older models, being more easily cleaned and having a better appearance. Newer models are fitted with oven thermometers which eliminate much of the guess-work previously necessary. They also have good draught control and can be heated to a high temperature. The oven capacity is good, and probably an experienced cook will turn out better scones and better roasts from a coal range than from any other type. A coal range will also heat water and warm the room.

However, a chimney is necessary with a coal range and extra work is involved in fuelling and also in cleaning the flues. Coal ranges are not designed to give continuous burning and are therefore not ready for use each day until they have been cleaned out, reset, and lit. This involves early rising for the cook, unless some subsidiary form of cooker will enable her to prepare the breakfast quickly. Although these ranges provide comforting warmth in winter, a good deal of heat is emitted and this may overheat the kitchen during summer.

COMPARISON OF TEMPERATURES AND REGULATOR NUMBERS FOR GAS STOVES

Temperature in degrees F.	250	275	300	325	350	375	400	425	450	475	500	525	550
Regulator No.	½	1	2	3	4	5	6	7	8	9	10	11	12

Coal ranges are equipped with chimney and oven dampers which can be regulated to make the fire burn and to heat or cool the oven to the desired temperature.

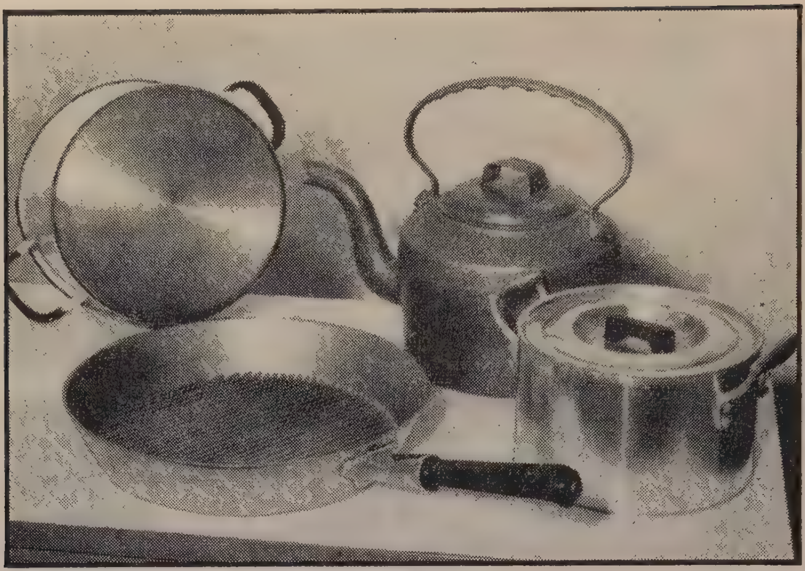
Oil Burners

Where solid fuel is difficult to obtain or when labour saving is a primary consideration, any standard coal range may be converted to oil burning, which may require the installation of a pressure system and involve some structural alteration to the range or merely the installation of a burner and gravity connection for fuel oil and removal of the grate and ash-pan.

With these burners very little attention to the stove is required and labour is saved both in the method of supplying fuel to the range and in the fact that the cleaning out of ashes and soot is not required. Heat is regulated by a small tap. Temperature is rather difficult to boost, but is very even. If the stove is not left burning continuously, it can be relit in a very short time. Stoves with burners will also give an excellent supply of hot water. The cost of installation is fairly high, but when the value of stoking and cleaning time is computed the initial cost may be justified.

Heat-storage Cookers

Heat storage cookers are specially designed for maximum fuel economy. The jacket is fully insulated and the hot plates, when not in use, are covered with insulating lids to conserve heat. They have a good appearance and easily cleaned, vitreous-



Ground-base utensils are necessary for efficient heat conduction with heat-storage cookers.

enamel surfaces. No chimney is necessary, but a flue pipe is attached to an outlet on the top of the stove. Correct installation and good-quality fuel are of vital importance for efficient running of the stove. These stoves burn only smokeless fuels such as anthracite and coke, the availability of which has already been discussed.

Initial expense is high, but when the correct fuel is obtainable economy in fuel costs will warrant installation of this type of stove. Different sizes are manufactured. Most have two ovens, one for roasting and one for simmering, but some of the larger models have four ovens, which can be regulated to temperatures suitable for roasting, baking, simmering, and warming. These stoves can be fitted to a boiler to provide sufficient hot water for average requirements.

One of their major advantages is that they are continuous burning and the simmering oven can be used for cooking such foods as porridge and stews which have been brought to boiling point on the top of the stove and then require long, slow cooking. Some heat is radiated to give pleasant warmth in winter, but good kitchen ventilation is necessary for comfortable working conditions in hot weather.

It is claimed that fuelling is necessary only in the morning and at night, with riddling and removal of ashes twice a day. These requirements may vary, depending on the type of fuel and the demands made on the cooker during that time. Good results will be obtained only with the use of ground-base utensils which conduct the heat quickly from the hot-plate to the food.

A thermostat controls the speed at which the fire burns and also influences the temperature of oven or hot-plate. However, as these stoves maintain a moderately even heat, it is generally better to do high temperature cooking early in the morning and low temperature cooking after dinner, when some of the stored heat has been utilised.

Semi-heat-storage Cookers

The term semi-heat-storage cookers is used to describe cookers which give continuous burning and will burn any type of solid fuel but which are less heavily insulated than the fully insulated heat-storage cookers. Several types of these cookers are available, some having two ovens, one for roasting and one for simmering, and some having a roasting oven and a warming compartment. The roasting ovens are equipped with a thermometer. The cookers are finished in porcelain enamel, which gives a good surface for easy cleaning and a good appearance. Some models have a fire-box which can be used as an open fire when the cooker is not being used for cooking. They are connected to a flue pipe in much the same way as the more heavily insulated cookers, and can also be connected to the hot water cylinder, giving a constant supply of hot water.

Management plays an important part in producing the best results, but provided too many demands are not made at once, these cookers are efficient.

Neither the top space nor the oven space appears to be large, but with the use of ground-base utensils and pressure cookers and the simmering oven for foods requiring long, slow cooking excellent results can be obtained. Experienced cooks have found it possible to cater for double the number of people claimed for by the manufacturers. More frequent stoking is necessary than with the full-heat-storage cookers, but draught control is such that when the cooker is not being used the damper can be closed and the fuel will burn slowly for a considerable period. To start the cooker the spin draught control is opened and the temperature quickly rises. The top plate is fitted with an insulated cover which conserves heat when the cooker is not in use.

The initial cost is comparatively high, but the fuel consumption of these cookers is moderate, and their outstanding advantage is that any type of solid fuel may be used, provided it is the right size. They give off sufficient heat to warm a kitchen in winter, but in summer they may prove too hot unless the kitchen is well ventilated. However, this applies to other solid fuel cookers also.

Kerosene Cookers

Kerosene cookers are not used to any great extent in permanent homes, but may be useful in seaside cottages or camps. They have a portable oven, and if wicks and burners are kept clean, will give good results.

Rangettes

Various types of rangettes are available and may be used in small flats and caravans or as an alternative to the regular cooker. One which is fuelled by rock gas deserves mention, as it frequently finds a place in districts where electricity and gas are not available but where some form of quick, easy cooking is required. The gas is supplied in a cylinder connected to a governor which controls the flow of gas to the rangette. It is then operated in the same way as a rangette fuelled by ordinary gas.

Without a thorough consideration of all factors it is not possible to select a cooker which will give optimum service. Availability of fuel, economic factors such as initial outlay opposed to running and maintenance costs, the saving of labour both in fuelling and cleaning, hot water supply and space heating, and above all the capacity of the stove to provide adequate cooking facilities are the vital considerations. Each purchaser must compute these carefully and buy with the confidence that the resulting knowledge will give.

All photographs by Oddies.

Removing Grease Spots from Wallpaper

IF a grease spot on wallpaper is fresh, it may be partially removed by covering it with a sheet of clean blotting paper and pressing over the blotting paper with a warm iron. Further treatment can be by either of the following methods:—

1. Cover the spot with a thick paste of fuller's earth mixed with carbon tetrachloride, applied thickly at the centre and thinly at the edges of the spot. Allow this to dry thoroughly and then remove it with a soft brush.
2. Make a paste of powdered magnesia and water and apply this to the spot. Leave the paste to dry for 2 or 3 days, then brush it off with a soft brush.

These treatments may need to be repeated.

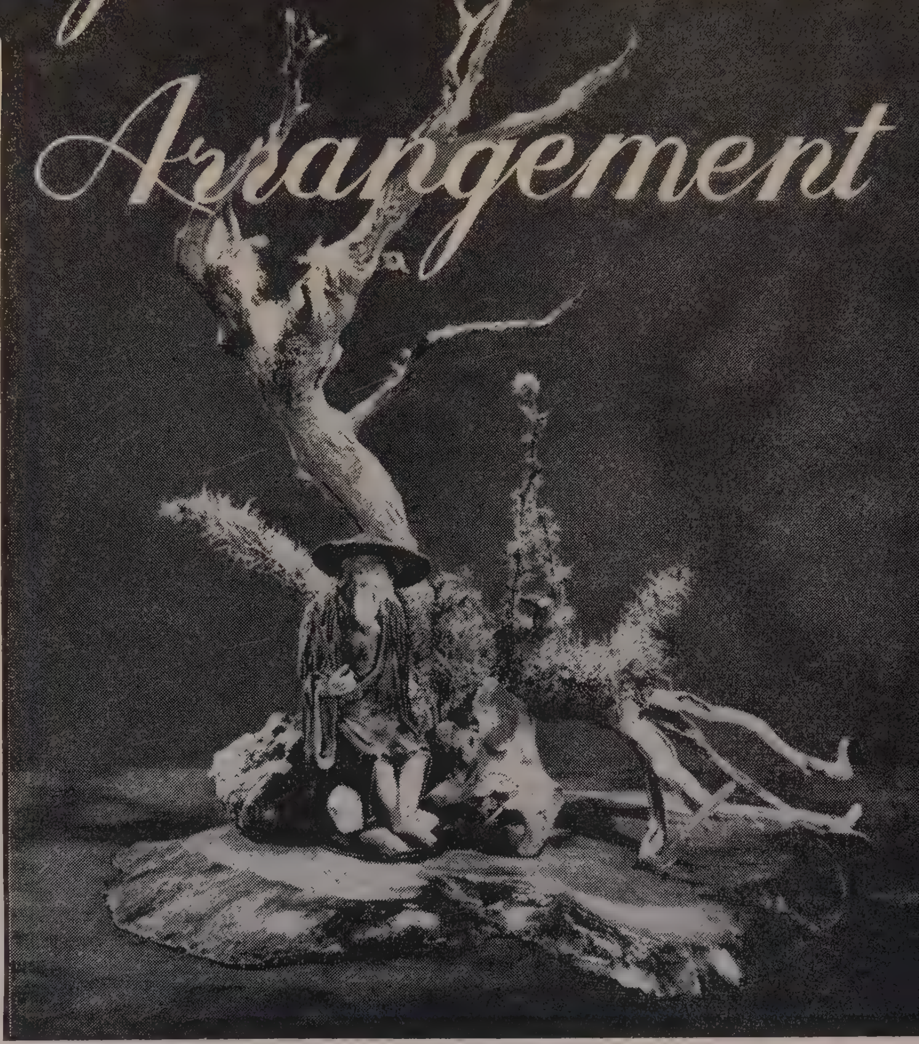
Before any chemicals are used it is always advisable to try them first on an inconspicuous part of the wall or on a spare piece of the wallpaper to see if they have any effect on the colour of the paper.

—*MAUD B. STRAIN,*
Field Officer in Rural Sociology,
Department of Agriculture,
Dunedin

Designed Flower Arrangement

Amateur Flower Shows

TO the enthusiastic horticulturist an amateur flower show gives opportunity of demonstrating skill in many different aspects of horticultural art—not only in the selection and raising of outstanding blooms and groups of blooms, but also in the tasteful designing of flower and foliage arrangements, alone and in relation to a variety of containers, accessories, and backgrounds. All these aspects of flower arrangement, as applied to home surroundings, have been discussed by Margaret O'Brien, Horticultural Department, Massey Agricultural College, Palmerston North, in previous articles of her series on designed flower arrangement, and in this, the concluding article of the series, she describes the points which must be considered for successful exhibiting at amateur flower shows and gives examples of various classes and the value of different factors for points scoring.



An arrangement based on a figurine, which forms the centre of interest. The design is informal line, the line of height being the width plus the length of the wooden base. The weathered branches and grey lichen add to the illusion of age and veneration suited to a Chinese patriarch.

AMATEUR flower shows must be educational if they are to fulfil their purpose and justify the time and energy expended on them. Their purpose is to raise the standards of horticulture and flower arrangement in the community. As local shows improve and membership of the organising bodies increases it is possible to increase the number of educational exhibits such as demonstrations of good garden practice, correctly named collections of flowers and plants, and technical demonstrations by officers of the Department of Agriculture and others. Novelties such as plants of recent introduction, new hybrids, and disease-resistant strains give interest and variety to a show. Garden features and garden planning exhibits where space permits are excellent and have been staged very successfully in New Zealand—several times recently by comparatively small societies.

It has been found as a result of long experience with large flower shows overseas that lack of proper balance between horticultural and artistic exhibits tends to lower the standard of the show. This offers a warning which should be heeded in this country, where arrangement classes are an ever-increasing feature of flower shows. It is the duty of the schedule committee to see that a show is well balanced between horticultural exhibits, flower arrangements, and educational sections. Novice sections for some, if not all classes, encourage newcomers, and junior sections should be included in as many classes as possible.

The judging methods and points systems in this article are from "The Handbook for Flower Shows, Staging, Exhibiting and Judging" by the National Council of State Garden Clubs, United States of America. The original handbook of the National Council was compiled in 1939, and after 10 years the standard of American flower shows had advanced so rapidly that it was considered necessary to gather the new information and incorporate the progressive practices in an up-to-date edition. Such valuable and extensive experience can well be adapted to local shows in New Zealand. If in some instances the overseas standard is a little beyond that here, it is something to be attained, and such an objective should give zest and stimulus to the promotion of progressive shows. To that end the National Council of State Garden Clubs, U.S.A., has kindly permitted the reprinting of some of the handbook here.

Judging Methods

The first step in judging is to check the class with the schedule; then each entry is "rough scaled" and those obviously unworthy of further consideration for awards are eliminated. Entries which do not conform to the schedule are also disqualified. "Not in accordance with the schedule" is perhaps the most tactful way to mark such entries. Obvious wiring and faking should be grounds for disqualification. Many local schedules are at fault in not making this point clear. The next step is to point score, accord-

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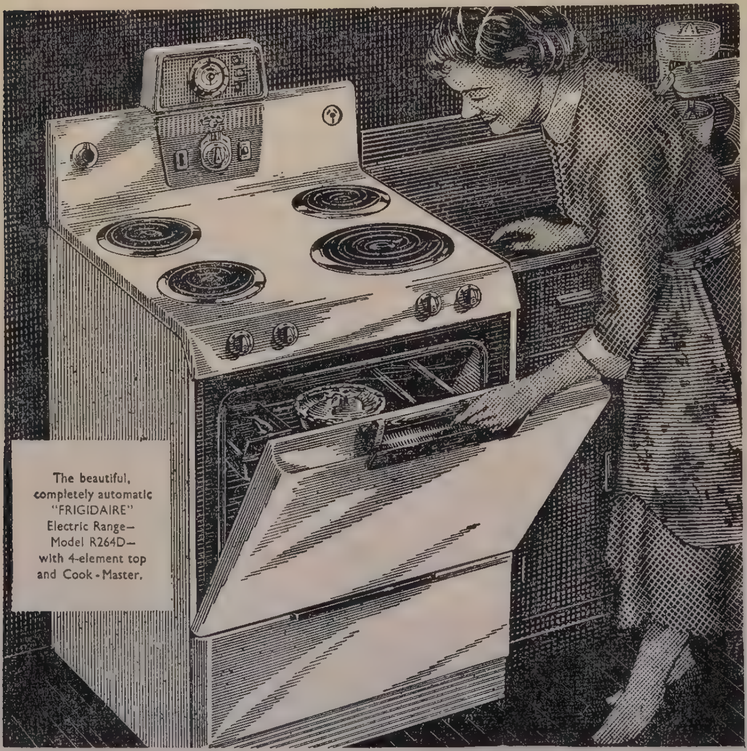

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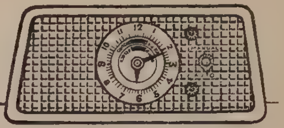

The Cook-Master gives truly automatic cooking. You can put a dinner in the oven at, say, midday . . . set the electric clock to switch on the oven at two o'clock and switch it off after three hours . . . then leave. When you return, dinner's ready—cooked to perfection and piping hot!

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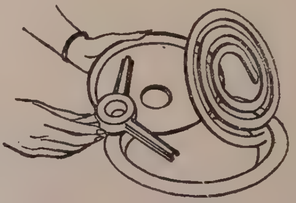

"Radiantube" Elements are made of a single tube that is extra wide and flat, so that more heated surface is in direct contact with utensils, bringing foods to cooking temperature more quickly. The "Radiantube" is most economical on current, provides 5 separate heats. Units are hinged, tip up for cleaning.

PLUS many other advanced features: 4 models (four-element and three-element with Cook-Master, and four-element and three-element without Cook-Master, which can be fitted as extra equipment); separate, clearly-marked switch controls for each element, providing five degrees of heat; thermostatically controlled oven; non-tipping, adjustable oven shelves; two elements in oven, with "eveniser" above lower element to give even distribution of heat throughout entire oven; thermostatically controlled warming drawer for plates and utensils; appliance outlet (for electric heaters, jugs, mixers) which can be automatically operated by Cook-Master on models having this feature; lifetime, acid-resisting porcelain finish.

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Frigidaire Electric Ranges

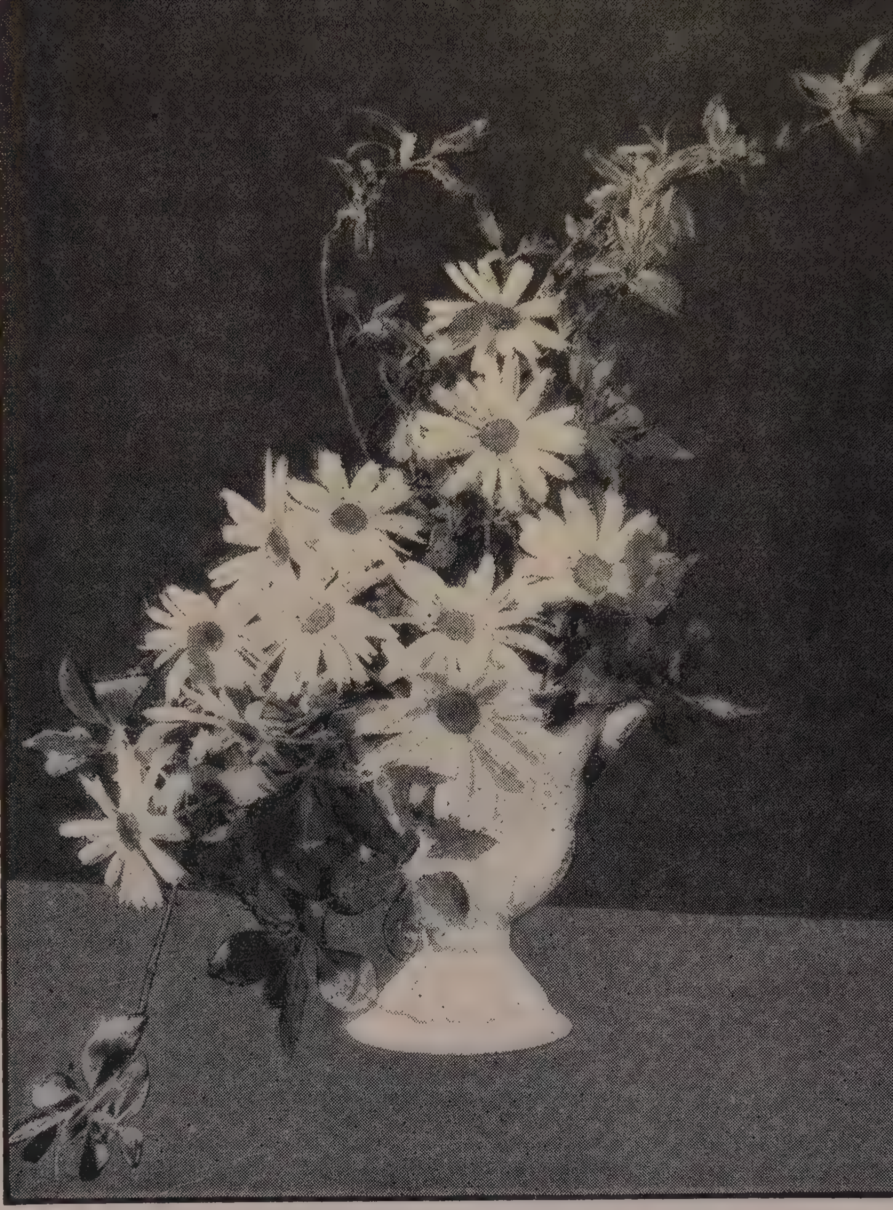
REGISTERED TRADE MARK

Distributed by FRIGIDAIRE Division of General Motors New Zealand Limited ing to the points system approved in advance, the remaining entries. Each entry is judged against perfection, usually represented by 100 points, and not against its neighbour. Points are taken off for imperfections and the remaining points added to make the final score. One first, one second, and one third prize are the usual awards, and in addition there may be several Honourable Mentions if the class is unusually good or the show a new venture for any particular club, when it is helpful to give all the encouragement possible. If on the other hand a class is poor, it is better to withhold one or more awards than to lower the standard.

If time permits, after a class has been judged, constructive notes on entry cards by judges are of real value to exhibitors, who appreciate recognition of their ability or the indication of an error, which they will avoid in the future. A judge is expected to sign all such notes, point score sheets, and prize lists if they are used.

A judge must be able to put aside all personal preferences and prejudices. Many judges are unconsciously influenced by colour appeal in one particular form and must watch this point closely. It is essential that their judgment be unbiased and always in accord with the rules and specifications laid down by the schedule concerned.

Mechanical aids such as lead strips or even Scotch tape are permissible provided they are not visible, that is, below the rim of the container or suitably covered. Exhibitors who allow needleholders to show are not likely to win prizes. Artificially coloured plant material is not generally acceptable, as it is contrary to the fundamental purpose of a flower show, which is the presentation of good horticulture and artistic arrangement.



An informal outline of forsythia branches in which the high line is balanced by a low, sweeping line which reaches almost to the table top but does not rest on it. The daisies follow these lines and grouped more closely give the necessary weight at the focal point.

Sample Classes

The following is a group of arrangement classes from the handbook of the National Council of State Garden Clubs, U.S.A.:—

1. An arrangement featuring colour. One colour must predominate. Staged against light-green background 42in. high, 32in. wide, and 40in. from the floor.

2. A study in silhouette. A line arrangement of flowering branches in a low container.

3. A miniature arrangement not over 3in. high. Staged in framed opening 3in. wide, 4in. high. Curved, light-green background. Depth of space 2½in., 40in. from the floor.

4. A dinner table set for six. Size of table: 72in, long, 36in. wide, and 30in. from the floor.

5. A one-place table setting for luncheon. An arrangement suitable for table seating eight, to be viewed from both sides. Size of table: 36in. long, 30in. wide, and 30in. from the floor.

6. An arrangement of spring blooms in any container, placed on a hinged-top console table. Table to be provided by exhibitor. Accessories permitted.

7. A composition of flowering material in combination with fruits and/or vegetables. Staged in a lighted niche 30in. wide, 40in. high, and 40in. from the floor. Sunlight-yellow background.

8. **Open class:** An arrangement of white-petalled flowers in a white container. Staged in front of a 3-fold screen painted light green. Centre panel 24in. wide and 30in. high.

9. **Open class:** A small arrangement not over 8in. high. Staged on shelf 5in. wide. Space allotment 10in. long; 54in. from the floor. Light-green background.

10. **Invitation class for neighbouring garden clubs only:** A large arrangement featuring flowering shrubs, planned for a special decorative purpose (to be stated), for example, church pulpit or wedding decoration. Staged on pedestal 38in. high. Diameter of top 15in.

Junior Classes

For Kindergarten, First, Second, and Third Grades

1. An arrangement in a favourite container.

2. Breakfast tray for a sick doll (must include a flower arrangement).

For Fourth, Fifth, and Sixth Grades

3. A miniature arrangement not over 6in. high.

4. A flower arrangement using colours of a bird or butterfly. Picture of same to accompany exhibit.

5. **Boys only.** A planting in a box approximately 12in. by 18in., showing a typical scene in any country studied by the entrant.

For Junior High

6. A still life composition suitable for use as the cover of a magazine (must include a flower arrangement). Composition not to exceed 20in. in width, 15in. in depth, and 27in. in height. Pupil to provide his own three-sided background.

7. **Girls only.** A one-place table setting for luncheon, including a flower arrangement, linen, china, and glassware. No silver allowed. To be staged on individual card tables provided by the committee.

8. **Boys only.** An animal made out of vegetables.

Further suggestions are:—

1. An informal line arrangement of bare or flowering branches in a low container designed for a study in silhouette. Not less than 12in. and not more than 18in. in height.

2. A study in combining a painting on the wall with one informal flower arrangement or a pair of formal ones on a shelf 60in. long, 10in. deep, and 64in. from the floor.

White flowers of *Cornus capitata* (the strawberry tree) with their rather metallic green centres are accented in fresh crispness against a polished copper pan.

3. A semi-formal mass design (Victorian) combining fruit and flowers in a tall container 12in. to 24in. high; suitable for an old world setting.

4. An arrangement of white-petalled flowers and any foliage, informal or semi-formal mass, in a container 12in. to 15in. long, 4in. to 8in. wide, and 3in. to 8in. deep.

5. A formal vertical arrangement (one side only) for the centre of a buffet table, including accessories.

6. A horizontal design for the end of a chest, not to exceed 2ft. in length and not to be less than 15in. in length.

7. A profuse design in a low, open container; the design not to exceed 2ft. in height and not to be less than 1ft. in height.

All these suggestions are merely general and would no doubt be modified by local show committees to suit their requirements and the particular season of the year.

Containers

The definitions of "a bowl" and "a vase" are widely debated, and it is preferable to leave these terms out of schedules and to use the word "container", the dimensions to be specified. Examples are: "A container whose greatest diameter is between 9in. and 12in. and whose depth is 4in. to 5in."; "a container whose greatest diameter is 9in. to 12in. and whose depth is 1½in. to 3in."; "a low, open container whose length is 12in. to 15in., whose width is 6in. to 9in., and whose depth is 1½in. to 2½in."; "a low, narrow container 9in. to 15in. long, 2in. to 3in. deep, 2in. to 3in. wide"; "a tall, upright container whose height is from 7in. to 12in. and whose average diameter at the lip is between 4in. and 7in." "Container" means deep bowls, shallow bowls, trays, troughs, and tall vases, etc. This method aims at grouping flower exhibits more accurately. A surprisingly wide range of containers comes within the bounds of the measurements given.

It is not necessary for every item in the show to be bound by measured limits, but such a method often avoids much discussion and undue importance being attached to the name of a container. The all-important aspect is the artistic value of the completed picture of flowers, container, and background. In this respect it is of interest that many of the American classes given in the examples state the measurement of the background or surroundings, thereby testing the exhibitors' ability to choose containers and material of good proportion.

Greater detail in show schedules would eliminate much doubt from the minds of exhibitors, and the publication of point scoring systems would act as a guide to the details of construction which would be considered by the judge. Some show committees question the expense of the printing involved in more detailed schedules, but probably fewer items in greater detail are of more value than a greater number of items whose brevity leaves room for doubt as to their exact requirements.

Points Systems

The value of the different factors in an arrangement for points scoring is indicated by the examples of points systems which follow:—

Flower arrangement with a definite purpose such as "for a hall table, a golden wedding, a period arrangement, for example, 18th century Georgian, or a mantel arrangement for a light modern room"

Colour combination	20
Relation to container	10
Design	20
Distinction and originality	20
Suitability to occasion	15
Suitability of combination	5
Condition	10
	100

Glossary of Flower Show Terms

Accessory—Anything used in creating an exhibit beyond plant material in the arrangement, container and base or fabric on which container may stand. This includes such items as background fabric, figurines, books, minerals, lid of container, additional plant material.

Annual—A plant that normally completes its outdoor cycle of growth in 1 year.

Basket—A container made of woven material, such as twigs, cane, rushes, or other flexible material.

Bloom—Individual flowers, one blossom on a stem. Examples: Roses (except cluster-flowered), large-flowered dahlias, large-flowered asters, carnations.

Biennial—A plant that normally completes its outdoor cycle of growth in 2 years.

Cluster—Several blossoms or fruits growing close together on the same stem. Examples: Most climbing roses, phlox, small-fruited tomatoes, and grapes.

Collection—An assemblage of a number of kinds or varieties of flowers, plants, fruits, and/or vegetables in one exhibit, the specific number and sorts of which should be regulated by the flower show schedule. Quality, variety, rarity, effectiveness, and range of the particular group as well as horticultural perfection are considered in judging collections. Size of collection, without other qualifications, is unimportant.

Display—The term generally used for a group of flowers, fruits, and/or vegetables, sometimes plants, covering a definite space or containing a definite number of specimens, or both, arranged to create an artistic effect. It is judged both for quality of materials and artistic effect. The term should be used rather than "collection" where artistic effect is stressed.

Disqualify—To remove an entry from consideration by the judges because of some defect which is the exhibitor's fault. Examples: It did not conform to the schedule or contained something artificial or forbidden by the rules, or had some other fault. The reason for disqualifying should always be written on the entry card.

Distinction—A quality in any arrangement which is notable for its creative use of plant material.

Foliage—The leafage of a plant.

Herbaceous perennial—A plant which lives longer than 2 years but which, in colder climates, dies back to the ground each winter.

Kind, genus, type—The Royal Horticultural Society considers that for horticultural exhibitions and for general gardening use two terms only are necessary to designate plant material: Kind and variety. This ruling has much to recommend it. Kinds are such separate genera as peaches, apples, plums, peas, carrots, cabbages; roses, chrysanthemums, phloxes. Different types of the same genus are also considered as kinds for exhibition, as snap beans and lima beans; dark grapes and white grapes.

The rule book of the Royal Horticultural Society says: "As a general rule, for the purposes of exhibiting, all natural genera are kinds, and all variations within a genus are varieties". Some exceptions are made which do not apply to New Zealand conditions.

Miniatures—3in. to 4in. over-all, including container and flowers.

Niche—A recessed space.

Novice—One who has never taken a prize. This definition may be changed to suit individual groups.

Originality—This is expressed in the use of uncommon material or of common material in an unusual way. It does not mean "bizarre". Beauty should be the aim.

Overcrowding—Use of too much material in a flower arrangement—a common fault. Only the smallest amount of material necessary to give the desired effect should be used.

Semi-miniatures—4in. to 8in. over-all, including container and flowers.

Shadow box—Technically, a box arranged for the pictorial effect of material exhibited in it, where the placing of the lights produces shadows which are planned as a part of the composition. In most flower shows the term is used simply for a box with artificial lights. (See points table on page 111.)

Size—This quality, though desirable to a certain extent, in fruits, vegetables, and flowers for exhibition, should not be stressed to the disadvantage of other qualities, such as flavour in the food products or beauty of colour and grace in the flowers.

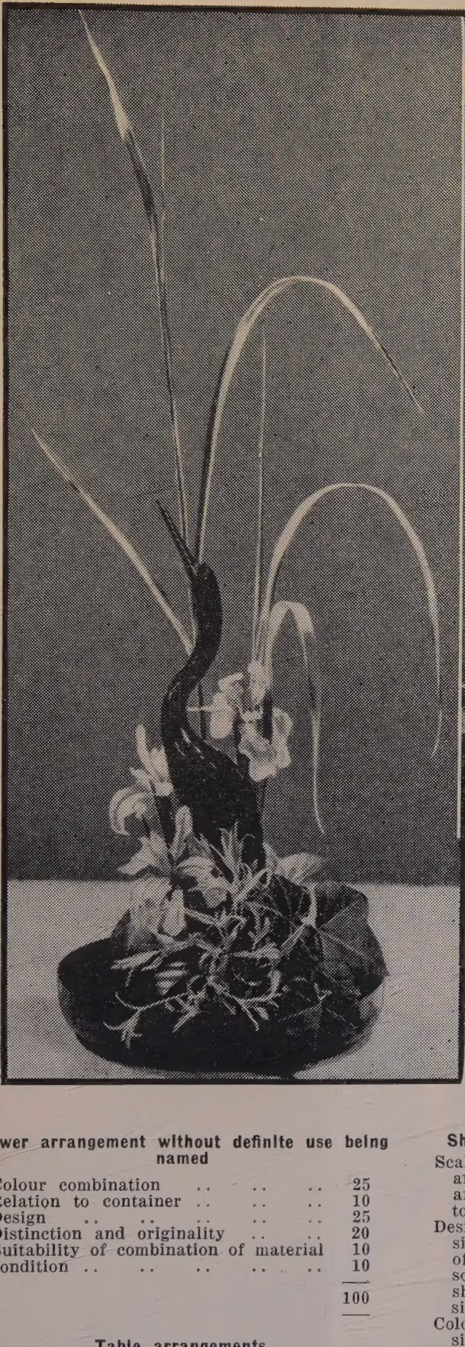
Spike—A flower structure with flowers stemless on a common lengthened stalk. Used sometimes where stems of the individual flowers are very short. Examples: Gladiolus, antirrhinum.

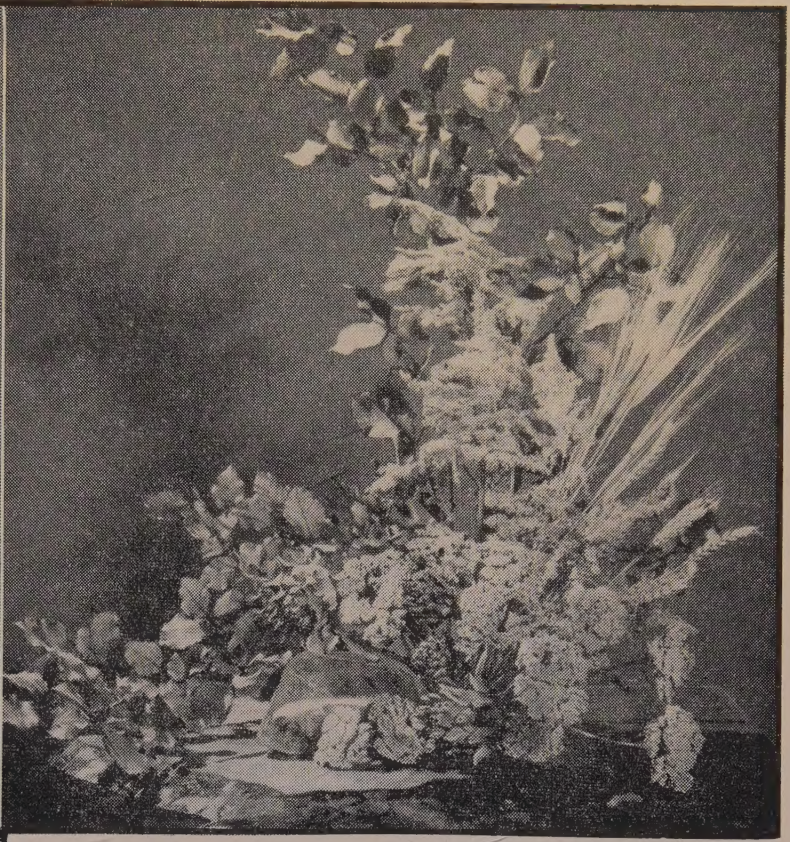
Spray—Portion of a plant with a number of flowers on one stem. Examples: Pom-pom aster, salpiglossis, cosmos.

Stem—The main ascending part of a plant. It is often used in flower shows for either the whole or part of a plant. It is a useful word, but should have some limitation in the schedule, as one exhibitor might bring one marigold and another the whole plant cut off.

Still life—As used in flower shows, the word usually means a flower arrangement with other objects designed to make a composition or picture. The arrangement is usually shown in a shadow box or recessed space.

White arrangements—For schedule use the term "white-petalled flowers" precludes a diversity of opinion as to the colours of flower centres in an arrangement that calls for white flowers only.





At left—The black crane provided the inspiration for the line of this arrangement. The material chosen suggests marshy surroundings, which would be the natural setting for such a bird. The design is simple, informal line. Above—An informal, profuse arrangement of dried material. The outline is of deep-brown copper beech leaves. This design is repeated in soft yellow heads of golden rod contrasted with straight lines of barley. The arrangement is weighted at the base with large heads of deep-golden yarra and heavy heads of globe artichoke. The container is a polished wooden plaque similar to that illustrated on page 179 of the "Journal" for February 1954. A piece of kauri gum adds weight at the base and reflects light, which brightens the muted tonings of the dried material.

Flower arrangement without definite use being named

Colour combination	25
Relation to container	10
Design	25
Distinction and originality	20
Suitability of combination of material	10
Condition	10
	100

Table arrangements

Distinction and originality	20
Colour harmony	20
Relationship of accessories (textures)	10
Perfection of centrepiece or decoration	20
Proportion and balance of accessories	10
Condition of material	10
Suitability to occasion or how well it conforms to schedule	10
	100

Miniatures

Scale	40
Design	30
Colour harmony	20
Condition	10
	100

Shadow box or recessed space (niche)

Scale: Size of arrangement, flowers and foliage, accessories (if any) and relation of all to space and to each other	30
Design: Line, mass, balance, emphasis, originality, as well as relation of flowers to container and accessories (if any), lighting and shadows (if these are to be considered)	30
Colour (if background is to be considered, take 5 points from colour)	30
Condition	10
	100

Cut-flower Classes

Cut flowers (applicable to all kinds)

Cultural perfection		80
Divided as follows:—		
Distinction of species or variety	20	
Size according to species or variety	20	
Form, colour, substance, and abundance of bloom	20	
Foliage and stem	20	
Condition		20
		100

This division of points is general and schedule committees will no doubt modify it to suit classes for specific blooms, for example, carnations.

Carnations

Colour	25
Size	20
Stem	20
Substance	15
Form	10
Calyx	5
Fragrance	5
	100

Collections

In collections arrangement will be considered only in cases of equal scoring.

Cut branches of trees and shrubs

Distinction as expressed in varieties shown	30
Cultural perfection according to variety	30
Rarity	10
Condition	20
Naming	10
	100

Display of flowers as cut roses, peonies, carnations, sweet peas

Arrangement and effect	40
Quality of bloom	20
Variety	10
Rarity	10
Condition	10
Naming	10
	100

Collections and Educational Displays

Collections and educational displays are of great value, but are not usually staged as competitive entries. The following points, though seldom used as a basis for judging, are helpful as a guide to the selection and display of material.

Collector's Corner

Plant material raised by amateurs, either singly, with some help from a gardener, or as a garden club

Cultural perfection according to variety	50
Distinction as expressed in varieties chosen	15
Correct naming	15
Size of collection	5
Condition	15
	100

Dish gardens

Arrangement	15
Proportion	10
Distinction and originality	15
Proper combination of material	20
Colour combination	10
Plants well established	20
Condition	10
	100

Garden exhibits

Design and consistency to scale	30
Suitability and quality of plant material	35
Colour harmony	10
Quality and suitability of accessories	10
Condition of plant material	10
Correct and suitable labelling	5
	100

Educational exhibits of wild or garden flowers or plants

Educational value	50
Labelling (correct botanical name)	15
Design	20
Condition	15
	100

New Zealand Collections

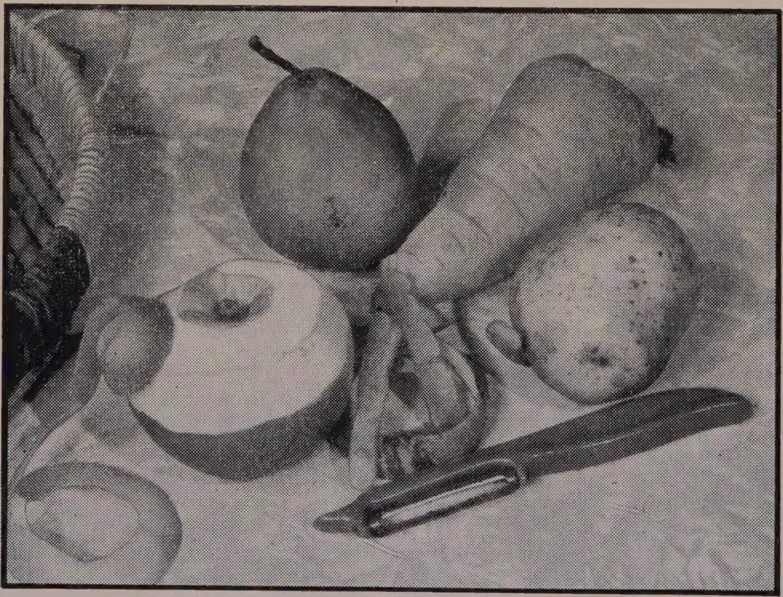
In a section for collections of flowers, foliage, or plants which are natives of New Zealand, invitation classes should be included. Invitations should be extended to well-known prizewinners and outstanding flower-arrangement artists in other clubs or nearby districts to exhibit their work for the benefit of others.

A flower arrangement displayed in each successive step of its construction is also helpful to beginners. Such an exhibit should be clearly labelled, for example, "Informal line arrangement, suitable for a very modern setting". The outline is the first step, and should be labelled as such, and the relation of the primary line to the size of the container should be stated. Next displayed should be the outline with the focal point in position, and finally the completed arrangement.

Demonstrations of good garden practice such as propagation, soil improvement, pruning, and pest and disease control are incentives to local horticultural activities.

Commercial or trade exhibits are helpful, and in accordance with the general educational value of the show their displays should aim to include technical information as well as good salesmanship.

Dual-blade Peeler



[*Oddies*

THE dual-blade peeler is a real time and labour saver. The handle is shaped to fit the hand of the worker and the peeler may be used by either a right- or left-handed person. The other end is a suitable shape for pitting the eyes from potatoes.

The peeler should be held comfortably in the hand and drawn over the fruit or vegetable with quick, easy strokes.

Although it is called a potato peeler, it can be used also for peeling carrots, parsnips, apples, and pears and it will de-string beans quickly and effectively. It automatically removes only a thin layer of skin, so preventing waste. Other uses are for slicing potatoes very thinly for potato crisps or for slicing carrots for carrot curls.

—*ELEANOR COUSTON, Field Officer in Rural Sociology, Department of Agriculture, Christchurch*

How to Launder White Nylon

TO keep white nylon white it should never be washed with coloured materials. Rain or other soft water, as hot as the hands can bear, and a good-quality soap or detergent should be used. It is very important to rinse the clothes thoroughly in clean water and to dry them in the shade. Soap suds and dirt left on nylon materials and exposure to sunlight cause a greyish or pinkish discoloration which is difficult to remove. The dinginess may be removed by soaking the garments in three or four changes of a solution of calgon in water of a strength of 1 teaspoon of calgon to a gallon of water.

This chemical removes the undesirable colour from fabrics, softens water, and is non-poisonous. Many housewives find it rather expensive, however, and this limits its wider domestic use.

—*BETTY M. JOHNSTON,*
Field Officer in Rural Sociology,
Department of Agriculture,
Wellington

Making Chipped Glasses Usable again

IF glassware is chipped but not cracked and so is still usable, the sharp edges of the chip may be rubbed off with fine sandpaper.

If it is necessary to remove much glass, wet the surface and rub it with waterproof silicon paper or a paste of carborundum powder, which is applied on a cloth. These materials will dull the surface of the glass, but rubbing the sharp edge off will make the article usable again.

—*EIRENE E. UNWIN, formerly Field Officer in Rural Sociology, Department of Agriculture, Christchurch*

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A STEWART SHEEPSHOWER MAKES THE TOUGHEST FARM JOB EASY!

Look into these practical "Stewart" Sheepshower advantages and see for yourself how superior this system is to the old methods. A recommendation from the Department of Agriculture resulted in the Stock Act being amended in November, 1947, to include the use of Sheepshowers as an effective means of dipping sheep.

1 NO HARD WORK:

The sheep walk in themselves, manhandling belongs to the past. Your dipping becomes a mechanical operation NOT a strenuous physical effort.

2 ELIMINATES INJURIES AND LOSSES:

As the sheep stand quietly and are not roughly handled there is no risk of damage to legs or other injuries. Even the weakest sheep can be dipped without fear of drowning.

3 LABOUR AND TIME SAVING:

At the most only 2 or 3 operators are needed. If necessary a farmer can do the job himself and be completely independent. As up to 2 dozen sheep can be dipped together and not individually as with old methods the saving in time is considerable.

4 COMPLETE COVERAGE AND EFFECTIVE SATURATION:

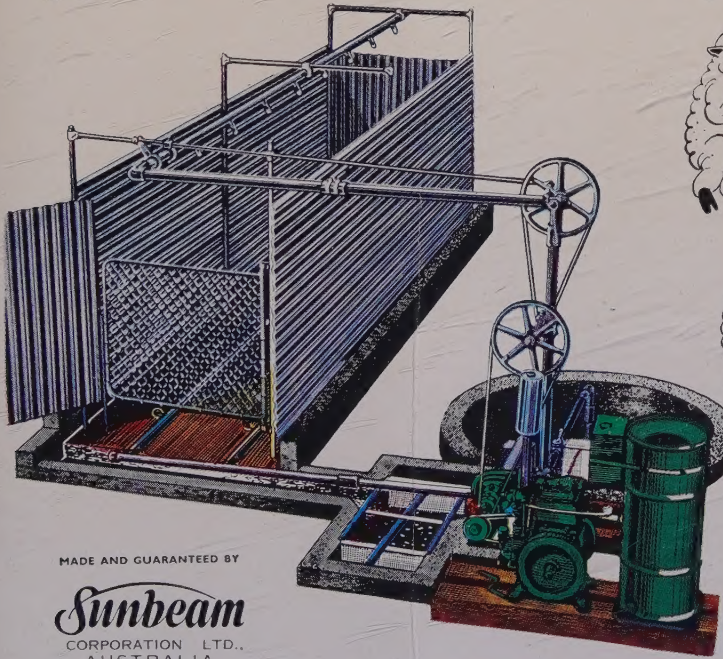
The entire area of a "Stewart" Sheepshower is covered by heavy spray under pressure. The sheep get maximum saturation regardless of where they are standing.

5 CLEANER WOOL:

As fresh wash is continuously used and thoroughly and effectively strained while in use, wool stain and discolouration is eliminated.

6 LESS DIP USED:

As the Sheepshower uses the wash down to the last few gallons very little of the dip is wasted whereas hundreds of gallons are left over after sheep have been dipped by the old methods.



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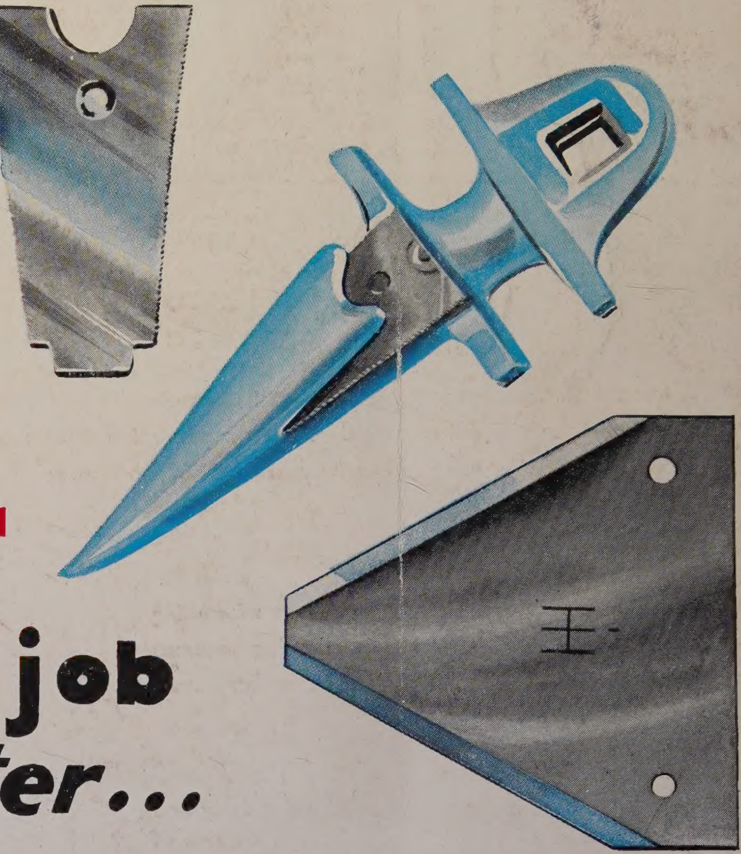

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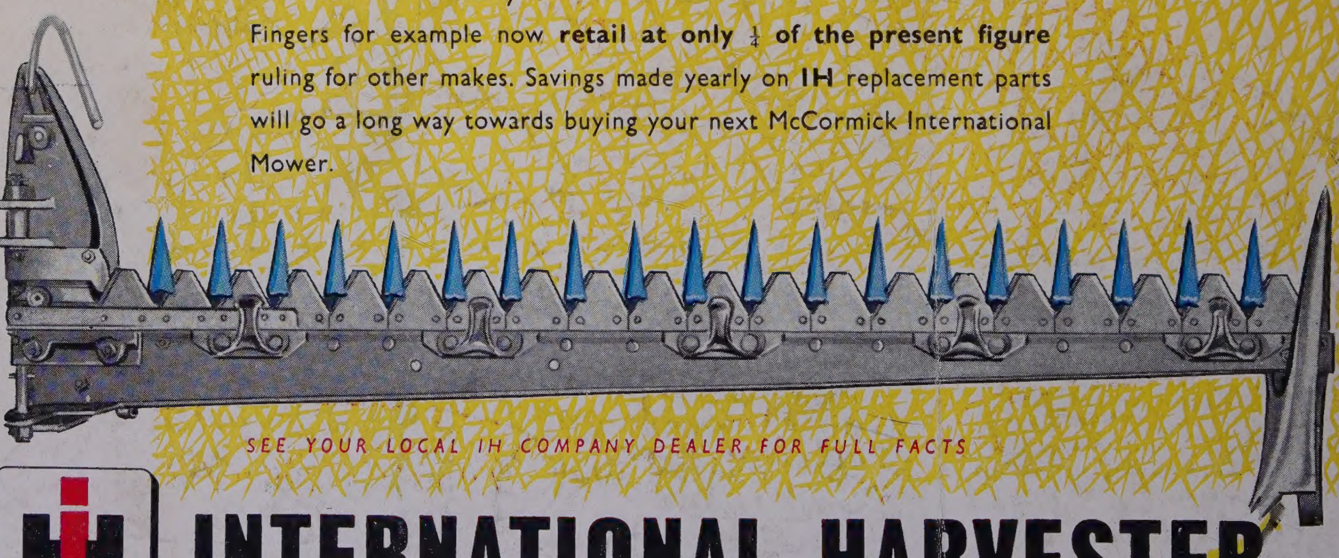

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